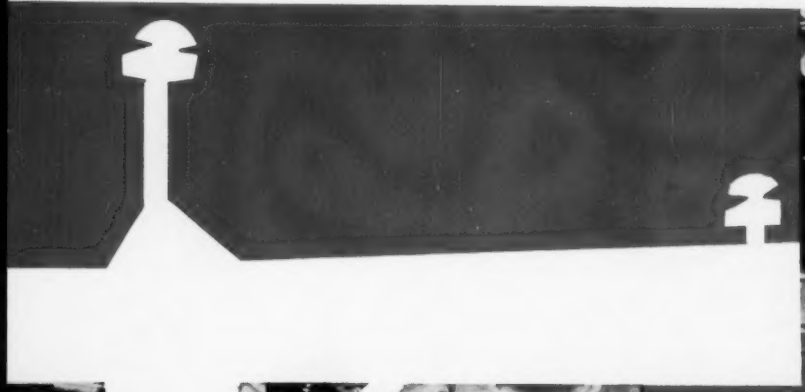
The Electrical Industry's Weekly Magazine

July 29, 1957

Electrical World

Price 50 Cents

A McGraw-Hill Publication



12 Kv Proves Success in Southern New England

...Page 58

Semiannual Index . . . Page 109

E B POWER GS W 12
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

DOWNTOWN SUBSTATION, where dense population demands greater safety, is one of several transformer applications in which the advantages of non-flammable, gas-filled units offer utilities large economies by eliminating costly vaults and fire-extinguishing equipment.

What does the future hold for gas-filled transformers?

Increasing number of urban and residential substations points up safety advantages of gas insulation

The growing concentration of load in heavily populated areas has required the location of more and larger transformers in substations in downtown and residential areas and adjacent to commercial buildings and factories. In each of these applications, safe transformer operation is becoming increasingly important.

Engineers at General Electric's Power Transformer Department, Pittsfield, Mass., predict gas-filled transformers will eventually replace oil-filled units for such applications, because gas-filled transformers—insulated and cooled with sulphur hexafluoride under pressure—greatly reduce possible fire hazards. Economies for electric utilities can total millions of dollars through the elimination of expensive vaults and fire-extinguishing equipment required for oil-filled units.

Two 69-kv, 2000-kva gas-filled transformers, believed to be the world's first, were shipped last year by General Electric. Preliminary design work on a third unit, rated 69 kv, 10,000 kva, has recently been completed. Field test information on these units, coupled with an intensive program of engineering development and design work, will enable General Electric to help accomplish the predicted bright future for gas-filled transformers.

There are several other advantages of gas-filled transformers compared with oil-filled units. They are 20 to 30 percent lighter for the same rating and operate at reduced sound levels.

For more information on gas-filled transformers, contact your General Electric Apparatus Sales Office. General Electric Co., Section 301-363, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 5 July 29, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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When A-Bomb Hits—the CD Alert

Studies and "damage" surveys continue on utility "toll" in recent Civilian Defense H-Bomb exercise.....p 45

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Water outlook for most federal hydroelectric projects is "good" to "excellent," but New Mexico suffers.....p 50

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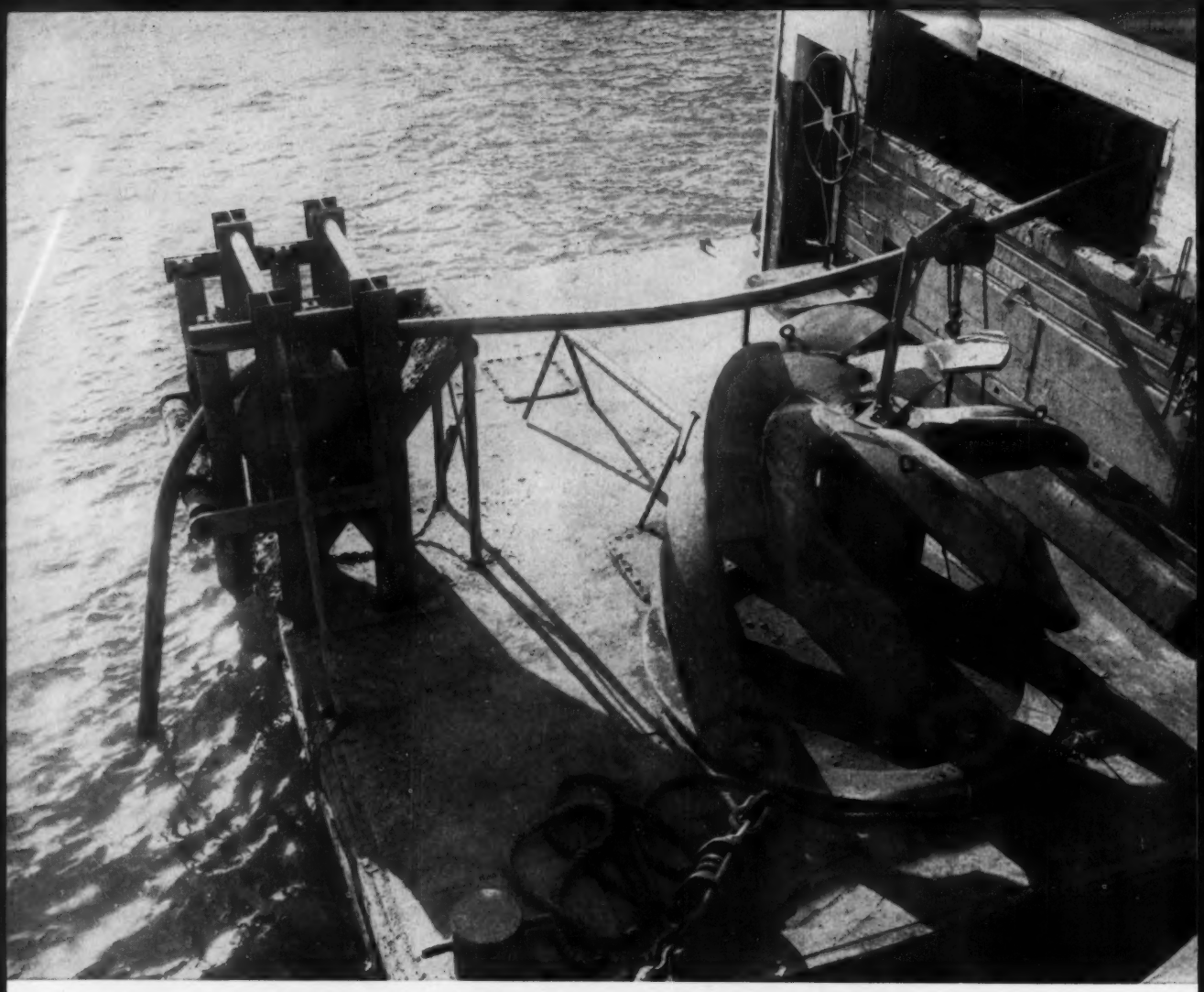

Built for a long life of hard knocks, this 4,500-foot, 3-phase, 20kv, shielded Okolite insulated cable with Okoprene sheath powers the rotary cutter head at right. Although nearly 5 inches thick, this cable has all the flexibility needed for dredging operations.

the previous OKONITE cable lasted 15 years ...but this one is built for even better service

Pacific Dredging Company has recently put into service an Okonite replacement for an Okonite 15kv armored cable that had seen fifteen years of successful service . . . two to three times normal expectancy. In the strenuous operation of cables feeding power to giant dredges from shore stations, five years' service life is considered good.

But the new cable was designed to last even longer than its predecessor. The major cause of breakdown in dredging cables has been deterioration of the armor wire, which breaks and punctures the insulation. To overcome this, Okonite engineers replaced the armor with a tough, mold-cured, reinforced Okoprene sheath. Although this construction has only been in operation for a year, Pacific Dredging Company is confident that it will outperform the old one.

This example of Okonite's constant determination to "better the best" shows why Okonite has always been considered a leader in developing and building the finest cables available. Do you have a cable problem? There's a good chance that Okonite engineers have already solved it. Find out today. The Okonite Co., Passaic, N.J.

4349

where there's electrical power . . . there's **OKONITE CABLE**

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. . . from the publisher

Three Additional Services

In these days when one reads so much in so many different newspapers, magazines, and books, it is often impossible to remember just where we read any one item. I know our readers have this problem because they make so many requests for the dates of issues in which various articles have appeared.

To help readers find articles which they have read in Electrical World, we offer three services: 1. We list all of the main articles in each issue on the Contents Page. 2. We publish a semiannual index. 3. We answer requests for such information by mail or phone.

In the back of this issue you will find the semiannual index for Vol 147 covering January to June 1957. Contrary to what you may think, it makes interesting reading. The hundreds of items listed in the 12 pages make a brief summary of the industry's progress in the past six months. You might also be reminded to read some article that you missed or meant to read but forgot.

Save this index and use it when searching for articles you believe appeared in this period. If you wear it out or lose it, you can get another without charge.

Fischer Black

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IT'S SPRING LOADED . . . GIVES YOU EVERYTHING!

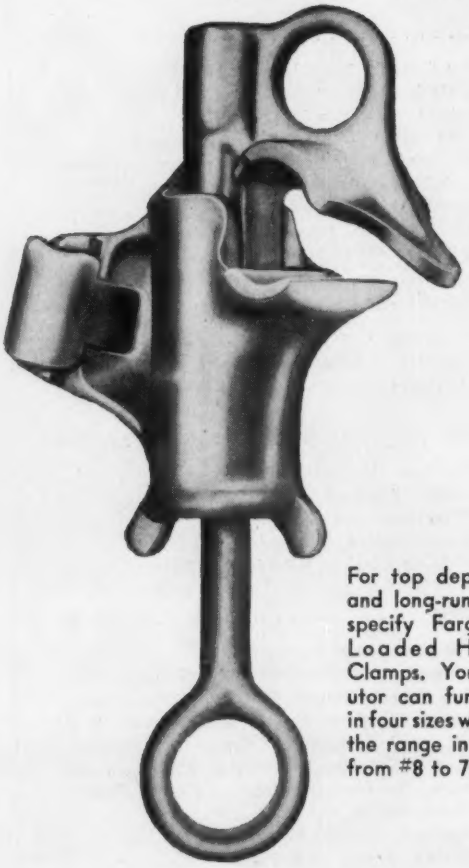
FARGO HOT LINE CLAMP

"AGE SERIES"

Bronze or plated bronze . . . aluminum or plated aluminum . . . you can have Fargo Hot Line Clamps for any combination of conductors! What's more, the "vise type" design with extra wide jaws gives superior conductor contact, minimizes conductor cold flow, holds down joint temperatures.

Other features of these Hot Line Clamps include jaws of identical metals so that thermal expansion is always equal. Large ears or lugs provide a positive grip with all makes of hot sticks. And then there's the unique spring.

The rugged Vanadium steel spring is the heart of the clamp. It makes up for variables caused by fault currents, load and atmospheric changes; compensates for the "relax" and "flow" tendencies of conductors under stress; offsets the different torque linemen use in tightening connections.



For top dependability and long-run economy specify Fargo Spring Loaded Hot Line Clamps. Your distributor can furnish them in four sizes which cover the range in wire sizes from #8 to 750MCM.

Ask your Line Material Field Engineer for complete details.

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

FARGO

LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM

picture of a man on his way UP

with tools and equipment from

Graybar

When you equip your linemen with the best tools you can buy, you utilize the full experience and skill of your men. And when you order linemen's tools and equipment from Graybar you have, at your disposal, the facilities of the largest single source of "Everything Electrical" in the world. Call your nearest Graybar office for every tool used from the bottom of the hole to the top of the pole. 733-97

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420 Lexington Avenue, New York 17, N. Y.

IN OVER 130 PRINCIPAL CITIES

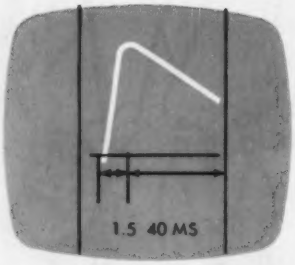
An example of Allis-Chalmers

world's first 600,000-kva transformer bank

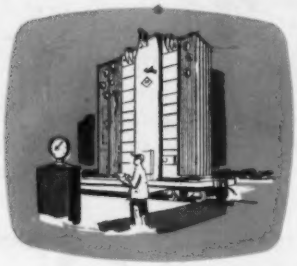
These three 200,000-kva, single-phase power transformers are now in service. Three duplicates are operating on the other end of a 345-kv transmission line.

Features of these transformers include:

- Corona-free design — prevents insulation damage due to corona. Testing included new switching surge test at 930,000 volts.
- Bank is rated 360,000 kva self-cooled, 480,000 kva with first set of fans, and 600,000 kva with a second set of fans.
- Lighter weight — Heavy plate aluminum in core and coil construction cuts shipping weight.



Tested for freedom from corona and switching surge capability



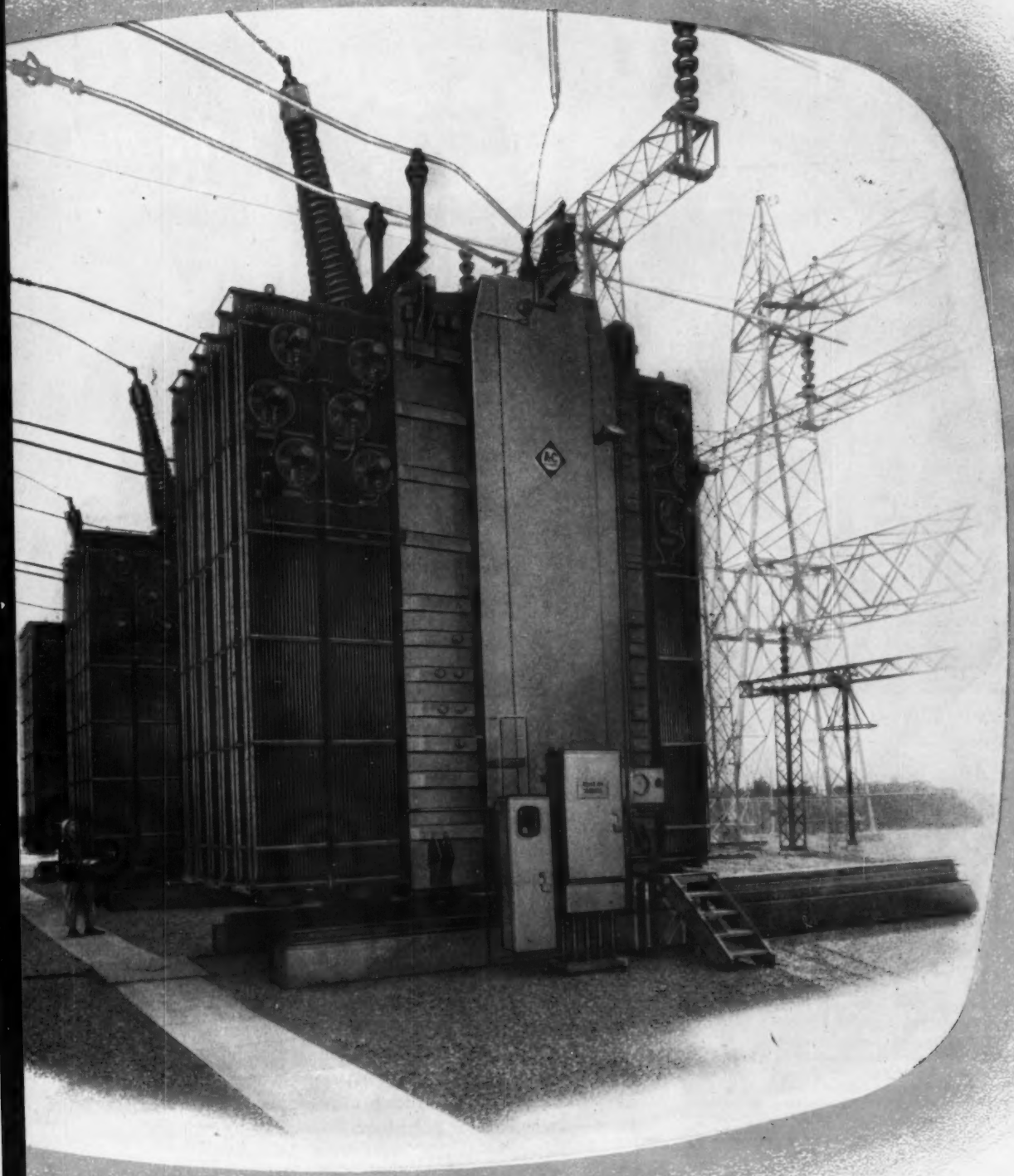
Use of aluminum cuts shipping weight

These units are examples of Allis-Chalmers leadership in helping power systems meet increased demands for power.

For information regarding latest transformer developments, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

leadership in transformers

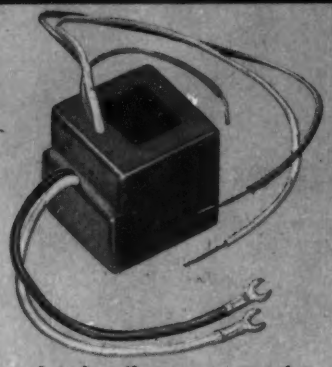


A-C
ALLIS-CHALMERS

A-5407

LOOK TO SANGAMO FOR DEMAND

thermal . .



Encapsulated coil assures maximum protection from lightning and high voltage surges. The potential transformer coil of the demand element is encapsulated in a specially developed epoxy resin with extremely high dielectric strength. Thus, the insulation levels of the demand element and the watthour meter element in these combination meters are equally high.

LINCOLN DEMAND METERS

Lincoln J2T thermal-demand watthour meters combine ± 2% full scale accuracy with exceptionally trouble-free performance to provide long life, low-cost demand measurement. Only two operating adjustments are necessary.

The J2T is ideally suited for application to singlephase residential and commercial loads. It is supplied with scale values of 12 KW, 24 KW, and 48 KW to take full advantage of the capacity of J2 Watthour Meters. A 12/24 KW or 24/48 KW scale is available for growing loads.

Other Lincoln Meters are available for polyphase demand measurement. Send coupon at left for complete technical information on Lincoln Meters and how they fit every application for billing measurement—singlephase or polyphase.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Lincoln Thermal Demand Meters.

Name_____

Company_____

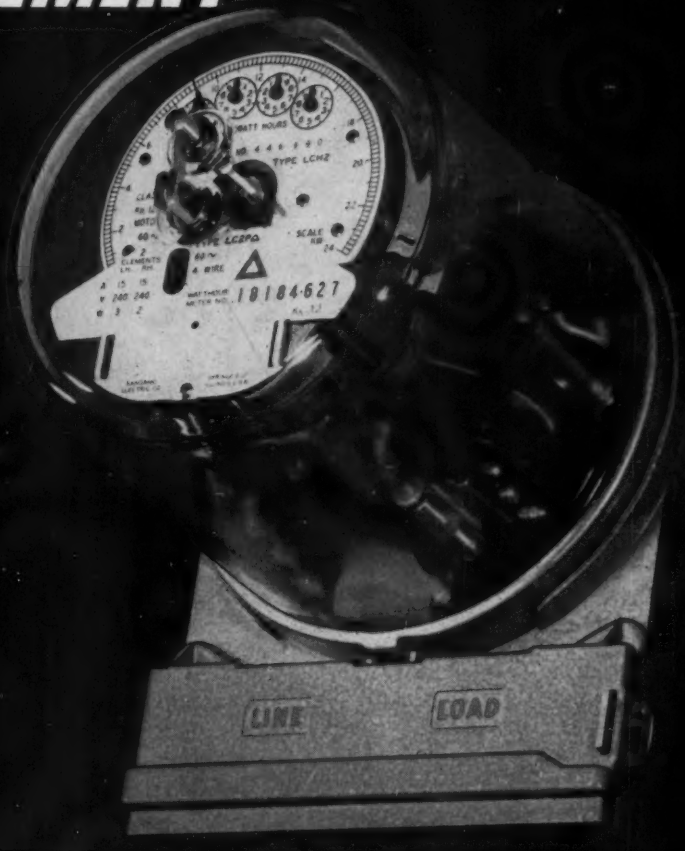
Address_____

City_____ State_____

SANGAMO ELECTRIC

MEASUREMENT

mechanical

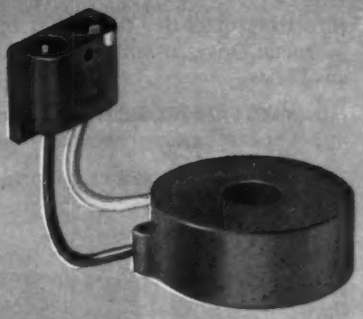


SANGAMO DEMAND REGISTERS

Sangamo Mechanical Demand Registers, both singlephase and polyphase, are built to give many years of dependable service within the guaranteed accuracy limits of ± 2% full scale. Only two adjustments, zero setting and idle pointer friction, are required.

The long service life of these demand registers is due to: 1. The Sangamo slow-speed, high torque motor; 2. The timing gear shafts with hardened, polished *stainless steel* pivots which turn in lifetime-lubricated porous bronze bearings; 3. The use of jeweled and nylon thrust bearings; 4. The dependable, clutch-free, gravity reset mechanism.

Both the JH2 (Singlephase) and LCH2 (Polyphase) registers can be field-installed on any modern Sangamo Watthour Meter without recalibration. Send the coupon at right for complete information on Sangamo Mechanical Demand Registers.



The heart of the Demand Register is the *timing motor*. The motor coil of the Sangamo Type H Motor is encapsulated in a specially developed epoxy resin with voltage breakdown in excess of 10,000 volts. The motor operates at slow speed, only 450 rpm. Special silicone grease packing permits stable operation from −50° to 250° F.

COMPANY *Springfield, Illinois*

SANGAMO ELECTRIC COMPANY, Springfield, Illinois.

Please send complete information on Sangamo Demand Registers.

Name_____

Company_____

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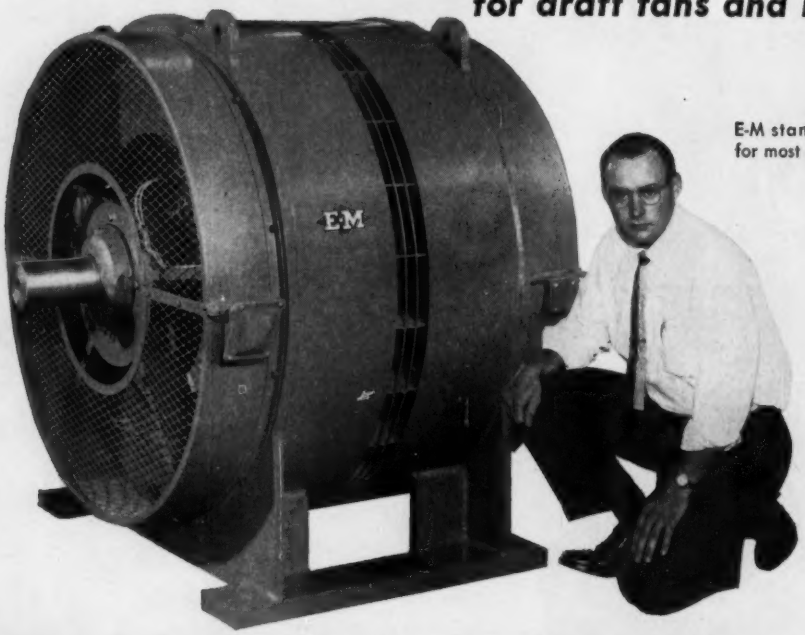
City_____ State_____

SH157-3

This is the latest in precise, adjustable speed control for draft fans and BF pumps!



E-M standard construction for most indoor applications.

REDUCE BOILER OPERATION COSTS

with one of the four *new* E-M ADJUSTABLE SPEED MAGNETIC DRIVES

- **More power in less space**
- **Simpler installation**
- **Better, quieter cooling**
- **Lower maintenance**

E-M Magnetic Drives help you reduce costs of auxiliary drive power and maintenance. Here's how:

LOWER POWER COSTS by eliminating need for wasteful throttling of boiler feedwater pumps and draft fans. Magnetic Drives *control speed* for efficient operation of auxiliaries.

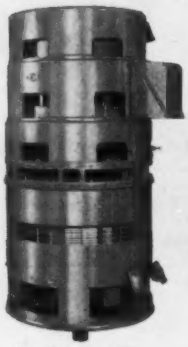
MINIMIZE FAN EROSION by operating fans at speeds to fit boiler combustion demands.

HAVE FAST RESPONSE to improve combustion and cut down thermal losses.

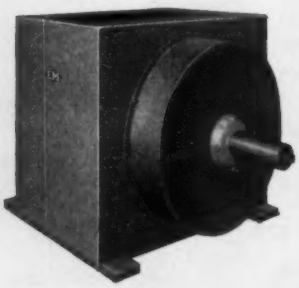
GIVE ACCURATE SPEED CONTROL. "Regutron" Control is responsive to *speed* of driven equipment regardless of changes in operating conditions. "Magnetic action" gives ±½% sensitivity. Anti-hunt and damping circuits assure stable operation.

OFFER BROAD SPEED RANGE. A large number of speed steps gives virtually stepless speed control . . . lets you select and keep exact speed.

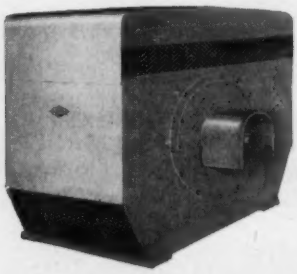
Write E-M for literature, or call your nearby E-M Field Engineer. He'll be glad to tell you first-hand all about the new developments in E-M Magnetic Drives.



Vertical E-M Magnetic Drive and Motor.



Top air discharge type for larger high speed ratings. Heat can be ducted away.



Weather-protected outdoor design. Screened intakes at feet, discharge near top.

E-M

4400-TPA-2175

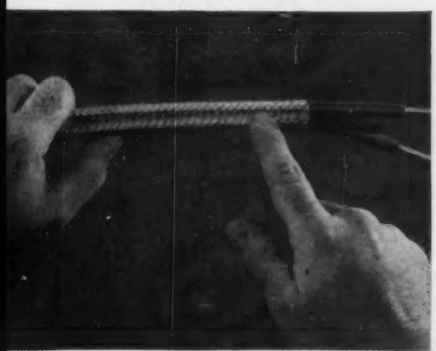
ELECTRIC MACHINERY MFG. COMPANY

Minneapolis 13, Minnesota

Specialists in making drives do **EXACTLY WHAT YOU WANT THEM TO**

Continuous cable run from pole to meter is provided by Kansas City Power & Light Co. with Type K service drop.

utility man ~~Woodman:~~ spare that tree— with Anaconda aluminum-armored service drop



Anaconda Type K Service Drop features two insulated aluminum conductors and a flat bare aluminum neutral. Tough aluminum ribbon covering over neoprene-insulated conductors reduces outages caused by foreign objects.

Unique Type K cable minimizes tree problems, contact hazard, power theft.

Installing service drop through trees is just asking for outages from chafing action of tree limbs. Trim the tree and you face an outraged owner. Besides, it's costly.

The ideal answer is Anaconda Type K service drop.

"In general this cable is self clearing in trees because of the sawing action of the bare neutral," reports Kansas City Power & Light Co., who has been a user of Type K for many years.

"In addition, Type K service drop:

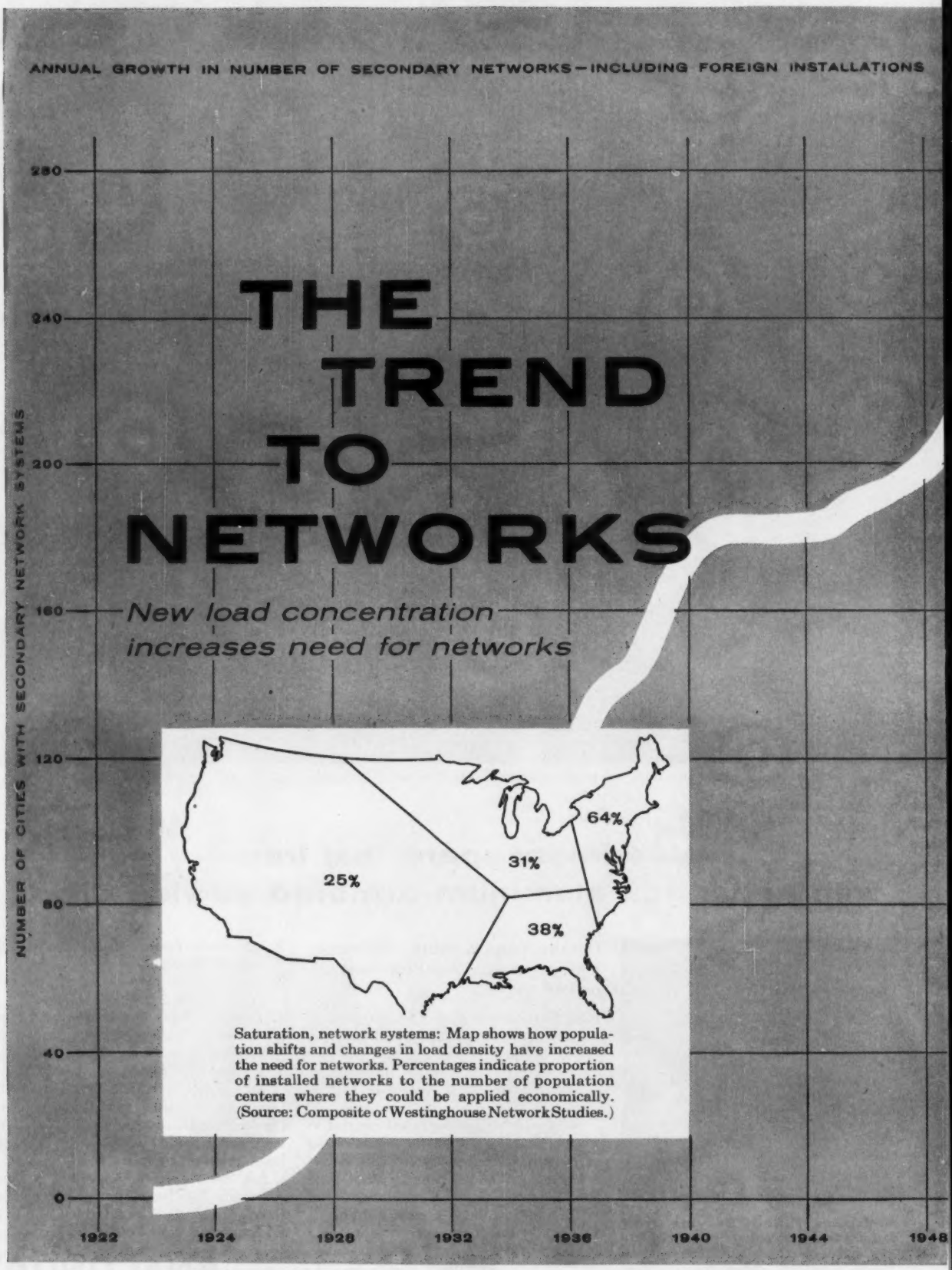
1. *Reduces threat of power theft.*
2. *Eliminates contact hazard to employees and the public.*
3. *Is more convenient to install and operate, especially through trees.*
4. *Eliminates abrasion of insulation, power loss, and interruptions of service because of burndowns.*
5. *Is more attractive."*

Type K cable is light, flexible, easy to install in unbroken runs from pole to meter. Standard accessories are used. Specially compounded insulation gives excellent electrical properties.

Ask the Man from Anaconda or your Anaconda distributor for full information today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

LIVE BETTER ELECTRICALLY

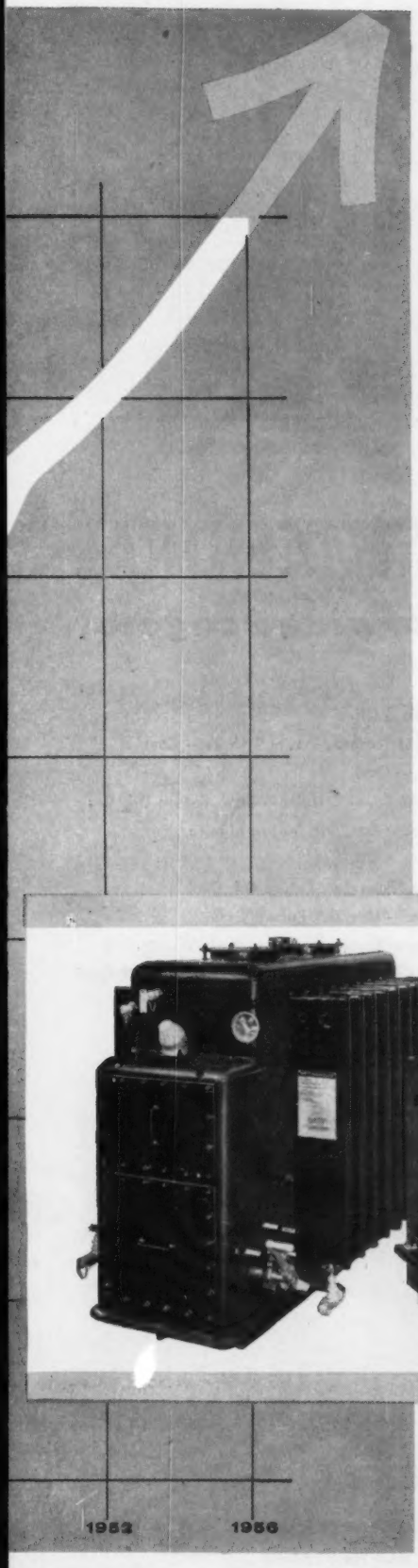
Ask the Man from **ANACONDA®**
for **ALUMINUM WIRE AND CABLE**



THE TREND TO NETWORKS

New load concentration increases need for networks

Saturation, network systems: Map shows how population shifts and changes in load density have increased the need for networks. Percentages indicate proportion of installed networks to the number of population centers where they could be applied economically. (Source: Composite of Westinghouse Network Studies.)



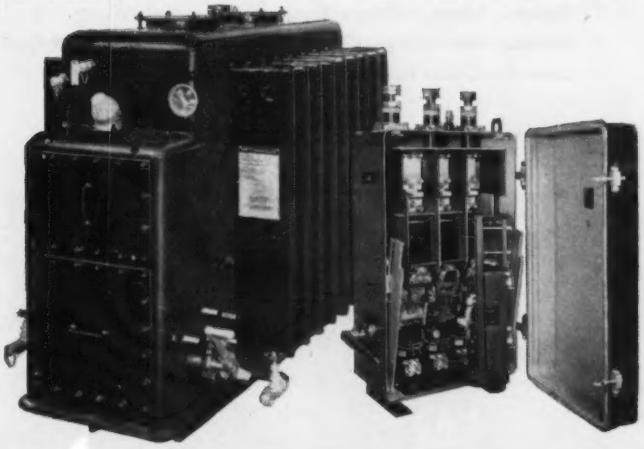
TWO FACTS STAND OUT:

1. Over 280 automatic a-c network systems have been put into operation since the first installation in 1922.
2. Westinghouse systems experts estimate that 58.1% of U. S. cities that could use networks economically do not have them.

Fact one, particularly in the trend of the postwar years, indicates that network systems are achieving increasingly rapid acceptance . . . thirty-four years of unchallenged superiority when accommodation for load growth, flexibility, and dependability are of paramount importance.

Fact two might indicate that many more cities should have networks under serious consideration right now. Do you have an area you serve where the a-c secondary network could be the answer to your projected distribution problems?

Westinghouse engineers will be glad to cooperate with you and your consultants in network studies. Westinghouse equipment can simplify your conversion and expansion problems. J-97201

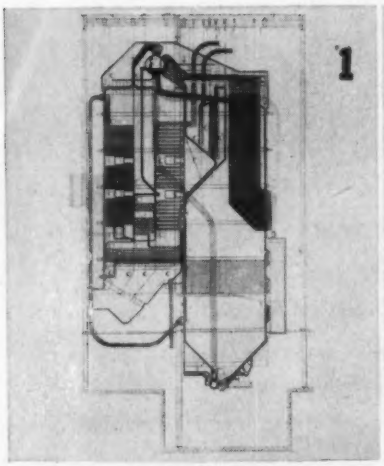


Westinghouse network transformer, liquid immersed, for vault installation below street or sidewalk level. Unit shown is Space-Miser design with new Yukon Coolers.

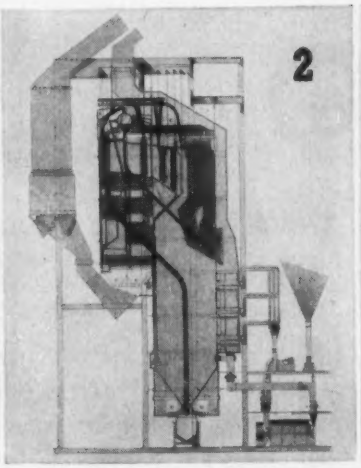
Standard Westinghouse network protector is shown, right. In addition to standard ratings, all classes, Westinghouse has developed units for heavy, medium and light load density in 120/208-volt and 265/460-volt service.

YOU CAN BE SURE...IF IT'S

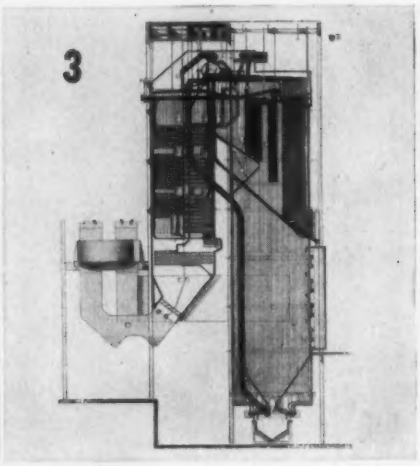
Westinghouse



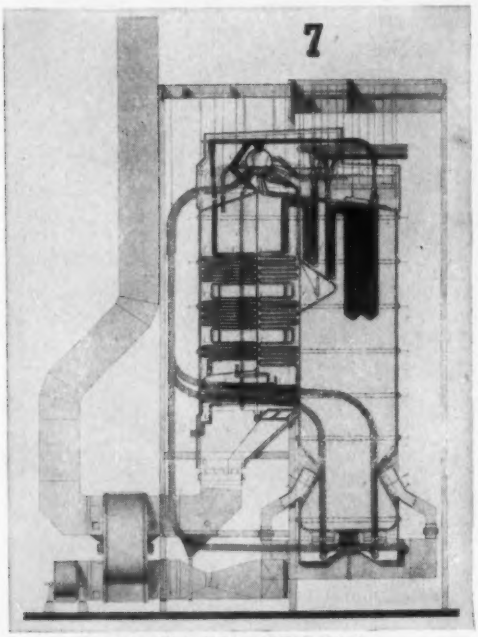
600,000#, 1700 psi., 1000 F. Reheat



1,000,000#, 2075 psi., 1005 F. Reheat



690,000#, 1650 psi., 1000 F. Reheat

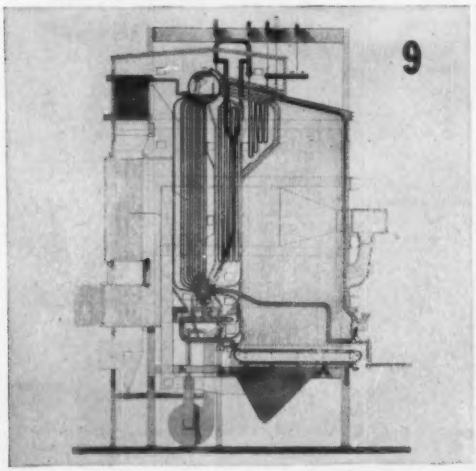


1,550,000#, 2125 psi., 1005 F. Reheat
TURBO FURNACE

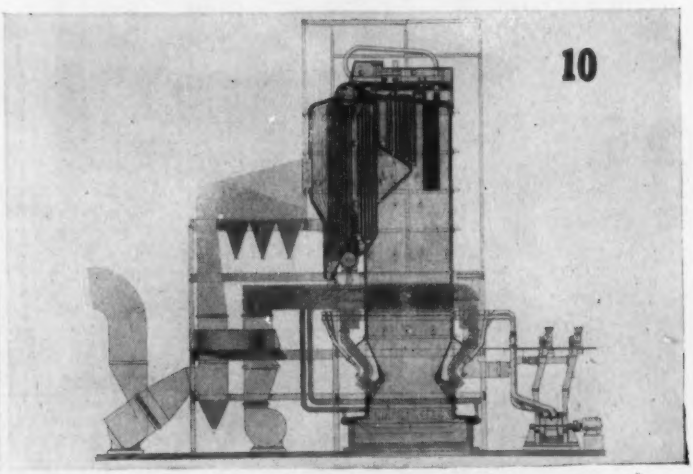
RILEY CENTRAL

that cover a wide range of

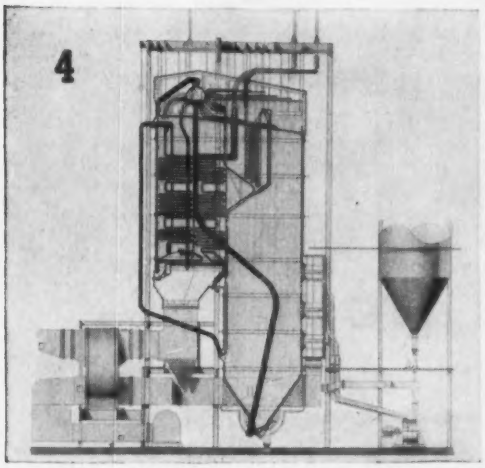
1. Florida Power Corporation – Oil
2. Public Service Company of Indiana, Inc. – 4 Units – Coal
3. Central Illinois Light Co. – Coal
4. Minnesota Power & Light Co. – 2 Units – Coal, Future Oil, Gas
5. Dallas Power & Light Co. – Gas, Oil, Future Lignite
6. Texas Electric Service Co. – Oil, Gas
7. Louisiana Power & Light Co. – Gas, Future Oil, Coal
8. Texas Electric Service Co. – Gas, Oil, Future Coal
9. Montana Dakota Utilities – Lignite
10. Delaware Power & Light Co. – 3 Units – Fluid Coke, Gas, Oil, Coal
11. Central Louisiana Electric Co. – 2 Units – Gas



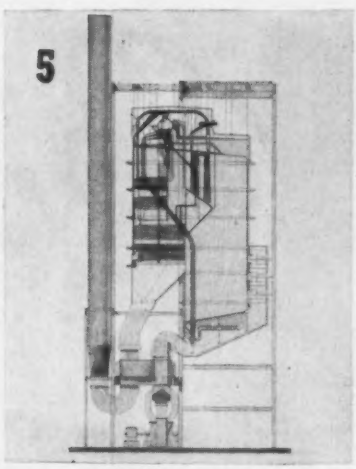
250,000#, 1025 psi., 905 F.



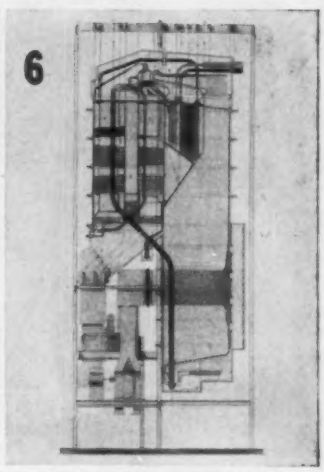
500,000#, 1425 psi., 950 F. TURBO FURNACE



500,000#, 1725 psi., 1005 F. Reheat



1,050,000#, 1725 psi., 1005 F.



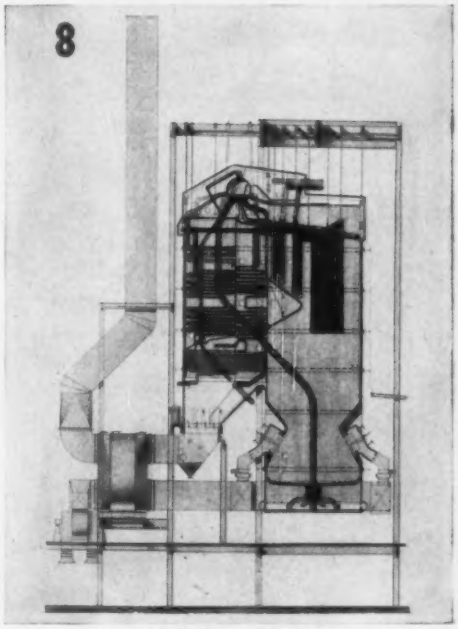
1,200,000#, 2125 psi., 1005 F. Reheat

STATION INSTALLATIONS

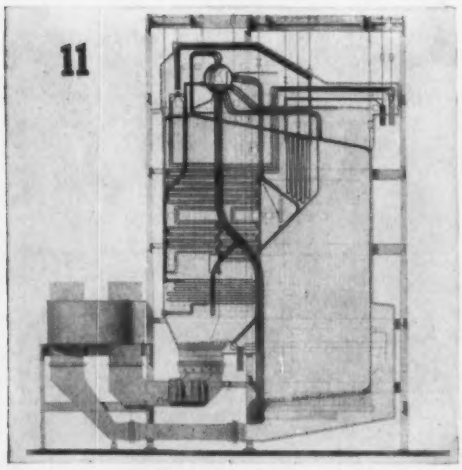
typical operating characteristics

These Riley Central Station Boiler designs are typical of many units that have been sold in recent years to a growing list of public utilities. This gratifying acceptance is a result of not only dependable and efficient operating characteristics, but because Riley, with its wide range of fuel burning products and the recent development of the TURBO FURNACE for multi-fuels, can offer the most economical solution to virtually any fuel burning situation.

Riley Boilers and Fuel Burning Equipment are *Designed, Manufactured, Erected and Serviced* under a single contract.



825,000#, 1750 psi., 1005 F. Reheat
TURBO FURNACE



350,000#, 1650 psi., 1005 F. Reheat

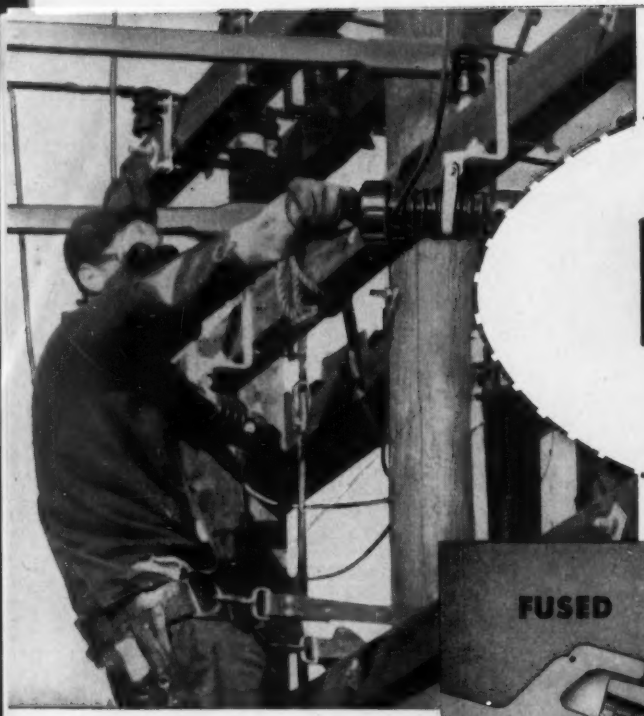
A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY

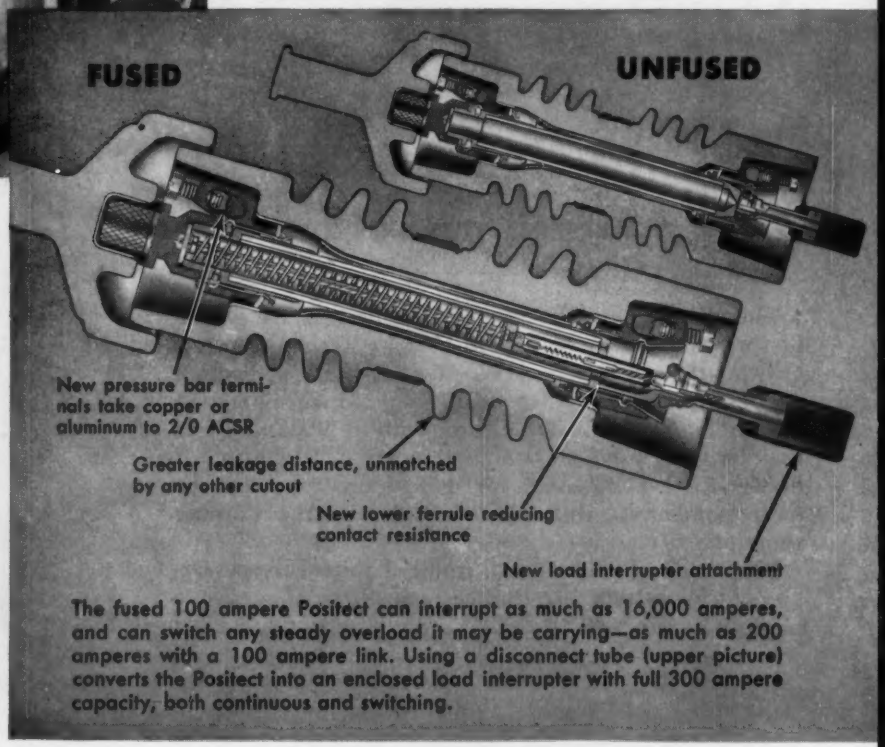
Stoker Corporation

WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver (Englewood), Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.



. . . a new S&C Positect CUTOUT


FUSED
UNFUSED
New pressure bar terminals take copper or aluminum to 2/0 ACSR
Greater leakage distance, unmatched by any other cutout
New lower ferrule reducing contact resistance
New load interrupter attachment

The fused 100 ampere Positect can interrupt as much as 16,000 amperes, and can switch any steady overload it may be carrying—as much as 200 amperes with a 100 ampere link. Using a disconnect tube (upper picture) converts the Positect into an enclosed load interrupter with full 300 ampere capacity, both continuous and switching.

the only enclosed cutout for switching . . . now with load interrupting ratings to 300 amperes unfused . . . 200 amperes fused

By means of a new load interrupter attachment, the S&C Positect now provides full load switching. This new capability is designed to take care of the heavier loads on today's feeders.

The S&C Positect is the only enclosed cutout for load switching. Moreover, its action is positive. There is no external arc—no exposed hot parts. No links are broken.

Load switching capability is not the only "plus" for the Positect. For short circuit protection it's tops, too, besides having unique safety features for the lineman:

1. It is designed and tested for closing against a fault —"make" as well as "break."
2. Blast is directed away from the operator, so he is out of reach of the arc, flame and "shrapnel" in case he closes on a fault.
3. Kickback is prevented by high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
4. Blast is minimized by arc shortening and freer venting.

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **Operating departments will want to look again** at their plant maintenance schedules—especially major machine overhaul which involves days or weeks of downtime. Recent heat wave outages and load curtailments show that summer peaking is still moving northward. Utilities experiencing summer peaks above the previous winter peaks are forced to schedule maintenance for other slack seasons.

Heavy interconnections between the Pacific Northwest pool and the Midwest are sure to come in time even though the first tests some months ago didn't prove out. What's needed is heavier ties and the coordination of frequency regulation between the two systems.

More than 31,000 newspapers, TV and radio stations, and other media will have carried "Live Better . . . Electrically" messages by the end of 1957. Progress report on the industry's number one promotion program will be carried in the August 19 issue of EW.

LATE NEWS ▶ **Federal Hells Canyon bill is killed by House Interior Committee** by 16-14 vote. For earlier story, see page 48. Senate bill still pending.

Government-financed power reactor program is a step closer now. Democratic-controlled Joint Congressional Committee on Atomic Energy approves a bill authorizing $268 million of AEC construction in this fiscal year. Among authorized projects are five small reactors that will be government-financed and owned but operated by rural cooperative and municipal groups.

Private development of downstream Snake River project is endorsed by FPC Examiner Edward B. Marsh. He says Pacific Northwest Power Co's Mountain Sheep-Pleasant Valley proposal "is best adapted to . . . improving and developing this stretch of the Snake River."

Commonwealth Edison Co is in the clear on heat peak problems, it feels. Units out for routine and emergency overhaul are back in service, adding 400,000 kw to capacity since heat storm of June 17. Company figures its "temperature sensitive load," consisting of air conditioning and difference in diversity of refrigerators and freezers due to hot weather, is running 600,000 kw.

A rate increase averaging 7½% is sought by Commonwealth Edison Co. Revised schedules were filed with the Illinois Commerce Commission last week. The proposed hike would total $25.2 million a year. After taxes, the increase would bring in $10.8 million.

Congratulations . . . Charles E. Eble is elected president of Consolidated Edison Co of New York, Inc. He succeeds Harland C. Forbes who is now board chairman . . . At Kentucky Utilities Co, Floyd I. Fairman becomes president and R. M. Watt board chairman and chief executive officer . . . Southern Co ups L. H. Jaeger to vice president and treasurer and D. B. Peck to secretary . . . Francis A. Keane is elected a vice president and board member of Public Service Electric & Gas Co, Newark, N. J.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▶ **Electric utilities turned in a creditable performance** in last week's civilian defense exercise, but Department of Interior says there are plenty of kinks to be worked out (p 45) . . . Purchasing agents say that recent round of equipment price increases spurred very little advance buying. Generally they expect full across-the-board increases on many items but doubt that all price hikes will stick (p 45) . . . Western drought relaxes its grip as heavy rainfall and good snowpacks fill reservoirs (p 50) . . . Heat wave catches utility off balance (p 52).

WASHINGTON ▶ **House committee has killed the Hells Canyon bill outright,** but sentiment is running heavily in favor of state development of power at Niagara Falls. This week's legislative roundup tells how the big power bills are faring (p 48).

ATOMIC PROGRESS ▶ **The huge dome-like structures you've seen in sketches** of nuclear power plants are called "containment shells." Their purpose is to contain radioactive materials in the event of a leak or more troublesome incident in the nuclear reactor. These shells are expensive because they are built to withstand high internal pressures. Recent tests carried out by Sargent & Lundy indicate that use of metal plates or water within the shell can go a long way toward reducing steam pressures which might be built up. Results of the tests could go a long way toward reducing the expense and bulk of these shells (p 53).

GENERATION ▶ **"When are we going to do something about solar energy?"** asks Ted Baumeister, Columbia University professor and consultant to General Public Utilities. In a plea for more attention to the commercial utilization of solar energy, the widely known engineer and teacher imparts a few absorbing theses. For instance, he figures the U. S. could supply its electric power needs if it could convert the solar energy transmitted to just 100 sq miles of land area (p 62).

TRANSMISSION ▶ **Short-cut surveying method for transposing transmission line routes** from aerial photographs to actual ground lines has been developed for use by Columbus & Southern Ohio Electric. Method saves time and makes possible more faithful reproduction of the aerial photo route. Procedure makes use of a balloon and a mirror (p 63).

DISTRIBUTION ▶ **Narragansett Electric, caught in a load growth-site scarcity squeeze,** is working its way out by turning to higher voltage distribution. Over the past three years it has converted over 200 circuit miles from the former system standard of 4.16 to 12.47-kv. The new voltage was adopted after studies indicated that the shift to higher voltage in densely populated areas would be the most economical solution to system expansion. The 4.16-kv system is retained in some areas because of load density, proximity to substations, previous commitment in underground or aerial cable, or other reasons. One geographically isolated area of the system will be reconnected from 4.8 delta to 8.32-

kv wye. Operating experience with the higher voltage indicates a higher degree of reliability than with the previous voltage (p 58).

METERING ▶ **Detroit Edison figures it saves $15,000 a year** on meter handling through use of meter trucks which are hauled on vehicles with hydraulic lift gate. It reduces handling and packing operations (p 66).

HEATING & COOLING ▶ **Compact test unit for checking or preliminary testing** of window-type air conditioners right on the customer's premises has been developed by Max Chittenden of Consumers Public Power . . . Arkansas P&L has reduced its rates for electric home heating. The new rate applies to residential customers who have installed heat pumps or at least 4 kw of resistance heating (p 73).

SELLING ▶ **Consolidated Edison unveils modern all-electric dream kitchen** for apartment dwellers. Its design was based on results of a survey reported earlier this year (EW, Feb 4) under the title, "So We Asked the Ladies." . . . Southwestern Public Service Co offers new residential wiring code for cities in its service area (p 70).

FINANCE ▶ **The rediscount rate set by the Federal Reserve Board** could be a considerable influence in fixing rates at which electric utilities must borrow money. Two recent utility debt issues sold rather slowly which may be some slight indication that the financial community is looking toward higher interest rate levels (p 91).

FORECAST ▶ **General outlook for utility sales next year is good.** Residential consumption will be the driving force as average use climbs from 3,183 kwhr per customer to 3,444 kwhr next year. Industrial sales next year will be 4½% above this year. These forecasts are from our market research section which is already busy preparing our Sept 2 Forecast Issue.

PEOPLE ▶ **At California Electric Power Carl C. Ernst is new president and** Fred Oldendorf is new vice president and general manager. Robert Neuman rises to vice president in charge of the districts (p 96).

MANUFACTURERS ▶ **Sangamo introduces network meter** as initial development in new line of polyphase watt-hour meters . . . New splicing tape for use with either plastic or rubber cables will be marketed shortly . . . Order for Consolidated Edison's 340-Mw turbine generator unit goes to Allis-Chalmers . . . (p 85).

NEW EQUIPMENT ▶ **Time switch for auto-switch capacitor equipment** controls oil or vacuum switches. It may be used on pole-top or substation equipment. This device has sealable opening for time setting . . . New joint compound stops formation of high resistance aluminum oxide by sealing contact area from the air (p 76).

ENGINEERING TRENDS

New substation buses will cost less when designed with lighter members to capitalize on electrical and mechanical damping of short-circuit forces. If the bus's natural frequency is low enough to team up effectively with the electrical damping, forces can be cut as much as 75% under values computed by conventional methods. Investigation of existing structures will disclose that many of them have capability to withstand greater fault duties than their present ratings imply.

Charging-current limitations of ac cable may eventually be overcome by compensating equipment installed with it. Development of this solution will leave the choice between ac and dc transmission largely one of cost.

Insulated open-wire primaries positioned and supported by spacers from a messenger neutral offer another means of enhancing the service continuity of distribution systems in bad tree areas. This construction eases the making of taps and speeds repairs when severe storms cause damage.

Gasification in a separate chamber may solve the coal-fired gas turbine's susceptibility to bucket erosion by flyash. This method suppresses the flyash emission in the hot gas discharged to the turbine.

Aluminum joints maintain strength at higher temperatures when made with a new 95% Zn 5% Al solder. Melting at 715 to 725F and applied with a special flux, this solder can bond aluminum to copper, brass, nickel, or steel for applications which formerly required brazing or welding.

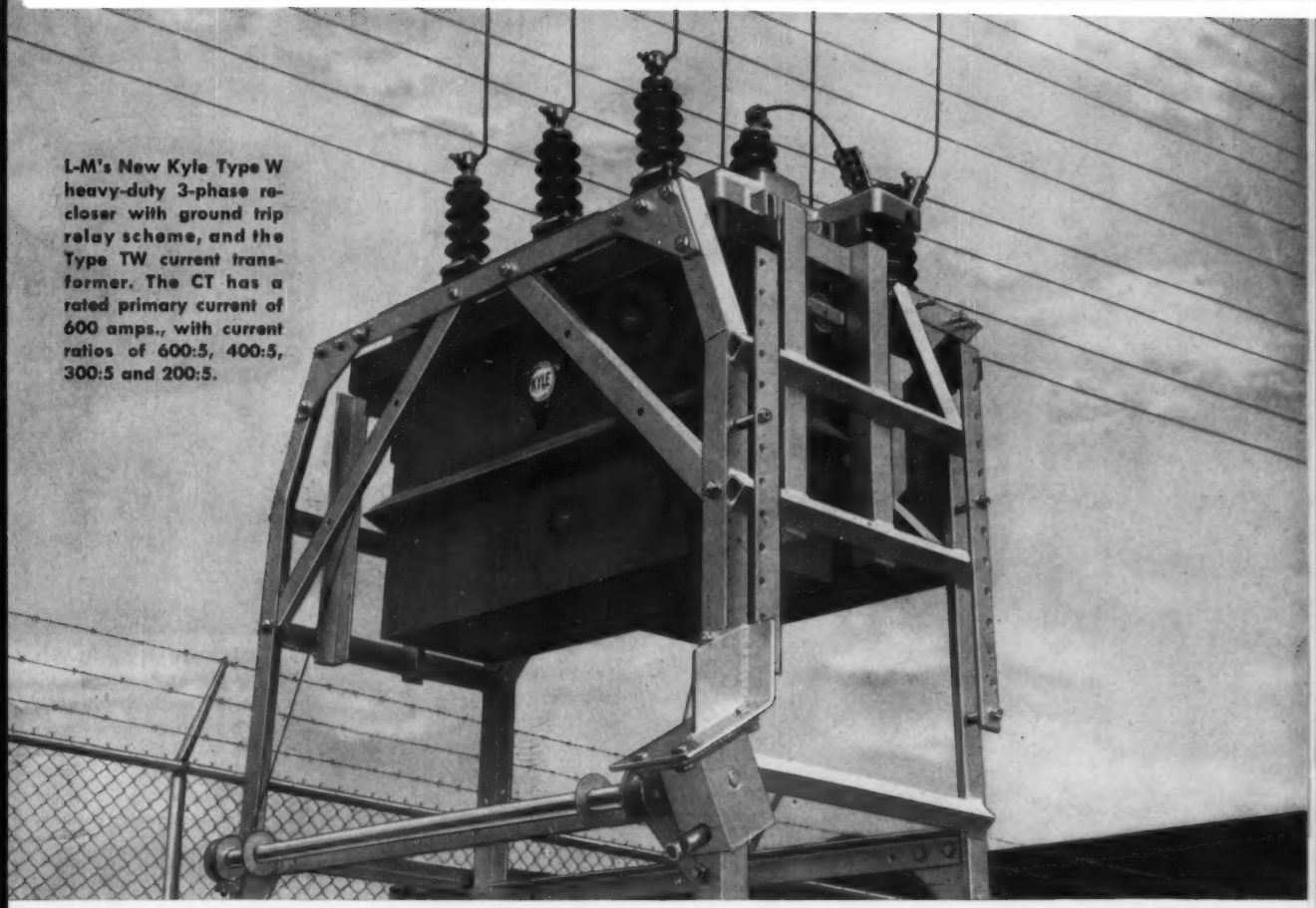
Shielding tape serves as the potential device on some French installations of single-conductor cable. The shield of the terminal section, isolated from the main cable, picks up enough energy to actuate protective relays.

FROM EDITORS IN THE FIELD

Lighting of hen houses spurs egg production by stimulating the hens' pituitary glands, not by merely extending their working day as has been the popular belief. And flies in Southern California hen houses are electrocuted by energized grids close under the roofs where they are prone to relax. Says the inventor, "Unlike DDT, there's no way a fly can develop immunity" to the dramatic bright-blue spark.

Silicone compound coating has checked flashovers of 120-kv cable terminals for 18 months at a Detroit Edison Co installation subject to severe industrial contamination.

Bombardment with rays from deep-pink glowing fluorescent lamps has caused guppies to bear 80% female fingerlings, compared with the natural 50-50 balance. Loyola University (Chicago) scientists ponder extension of this research to bigger fields.



L-M's New Kyle Type W heavy-duty 3-phase recloser with ground trip relay scheme, and the Type TW current transformer. The CT has a rated primary current of 600 amps., with current ratios of 600:5, 400:5, 300:5 and 200:5.

At Half the Cost of OCB's...

Substation Type W Recloser Gives Greater Protection With Fast 2½-Cycle Clearing

By **FRANK McSTAY**, Product Manager, Kyle Products, Line Material Industries

Now, with L-M's new high-speed Type W Recloser, conductor burn-down of distribution feeder circuits is reduced to a minimum. This completely automatic and self-contained 3-phase unit clears so rapidly that up to 90% of the faults on typical distribution systems are prevented from becoming permanent. In fact, the Kyle Type W clears in less than half the time of distribution oil circuit breakers. This instantaneous opening results in better fuse coordination and helps to confine permanent faults to a small area.

The Type W also offers another advantage: by reducing the length of time during which fault current flows, the recloser permits using larger transformers without increasing the size of the wire on the system, or necessitating reactors to limit the available fault current.

200 MVA for Half the Cost

Besides safeguarding the distribution circuit, the 3-phase Type W offers large savings in both initial investment and maintenance. The unit is approximately half the price of an equivalent OCB for the same application.

Series over-current tripping is utilized with a selection of five time-current characteristics—fast, retarded, or extra retarded—in two degrees of slope—with 2, 3, or 4 operations to lockout, in many combinations of operations. In addition, L-M has a complete line of auxiliary equipment to provide almost any supplementary relaying scheme.

Ratings from 100 to 560 Amps.

L-M's Type W is available in normal load ratings from 100 to 560 amperes, with symmetrical RMS interrupting ratings up to 12,000 amperes at 4.8 kv and below, 10,000 amperes at 8.32 kv and below, and 8,000 amperes up to 14.4 kv. Current ratings can be changed in the field by simply replacing the series trip coils.

Get Complete Information

Ask the L-M Field Engineer for Bulletin CRIW giving more information on how L-M's new Type W recloser can be profitably applied to your system. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

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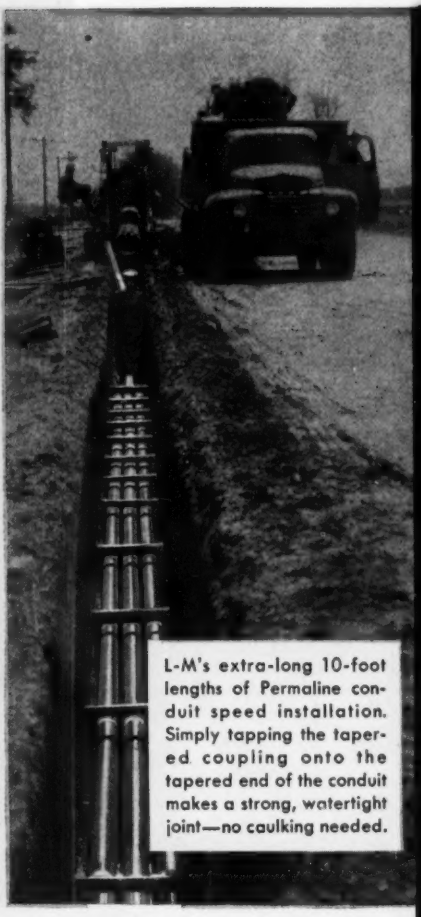
L-M's Permaline conduit is light, easy to handle, easy to install. One man can easily carry two 10-foot lengths.



L-M's extra-long 10-foot lengths of Permaline conduit speed installation. Simply tapping the tapered coupling onto the tapered end of the conduit makes a strong, watertight joint—no caulking needed.

Saves Time and Labor...

Contractor Eliminates 13,750 Joints

With Long 10-foot Lengths of L-M Permaline Conduit!

Now, with L-M's exclusive 10-foot lengths of Permaline fibre conduit, you can eliminate 20% to 50% of the joints to be made on a job, and thus cut costly construction time and labor.

On one job requiring 550,000 feet of conduit, the contractor eliminated 13,750 joints by using L-M's long 10-foot lengths as compared with 8-foot lengths.

It will pay you to use L-M's time- and labor-saving 10-foot lengths of Permaline conduit for your next duct job. Only L-M Permaline is available in these 10-foot lengths.

Easy to Install

L-M lightweight Permaline fibre conduit is also easy to install. Joints are quickly made by simply tapping the tapered coupling onto the tapered end of the conduit. Joints are watertight and safe from seepage. Smooth bore reduces cable sheath abrasion. Completely engineered system for installation includes full line of bends, bell ends, couplings, and base and intermediate spacers.

L-M Permaline fibre conduit comes in 5, 8 and 10-foot lengths. Available diameters include 2, 3, 3½, 4, 4½, 5 and 6-inch sizes.

Get Complete Information

Ask the L-M Field Engineer for a copy of the 12-point plan folder which shows how easy it is to use the Permaline system; or Fibre Conduit Bulletin UG1A, which gives complete specifications. Or write Line Material Industries, Milwaukee 1, Wisconsin.

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LINE MATERIAL Industries

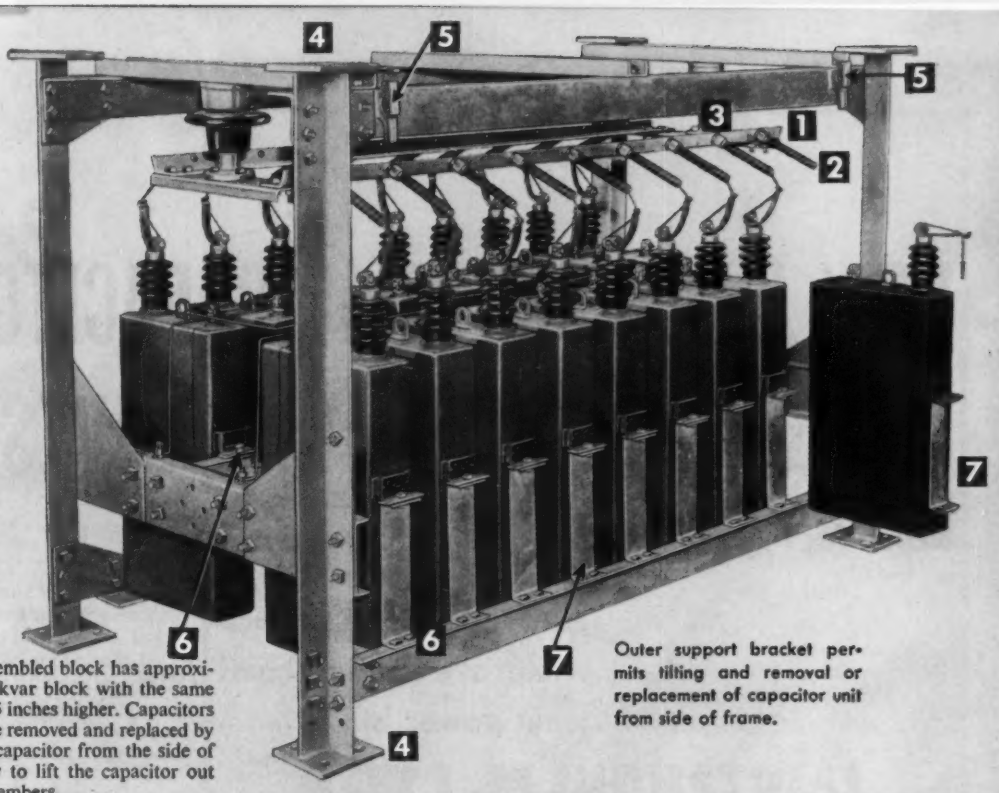
McGRAW-EDISON COMPANY

McGRAW EDISON

Permaline Fibre Conduit

BPI

This seal is your guarantee of recognized quality in Bituminous Fibre Conduit.


1 Aluminum-alloy bus
2 Bus-mounted fuses
3 Bus connections wire brushed and treated with oxidation inhibitor.
4 Jig-assembled for perfect alignment of mounting pad bolt holes.
5 Lifting lugs.
6 Tapped holes in frame for capacitor mounting bolts. Nuts not needed.
7 Outer support bracket permits tilting and removal or replacement of capacitor unit from side of frame.

L-M's new 50 kvar factory-assembled block has approximately the same area as a 25 kvar block with the same number of units and it is only 5 inches higher. Capacitors in L-M's 50 kvar blocks can be removed and replaced by simply tilting and sliding the capacitor from the side of the block. It is not necessary to lift the capacitor out from between the mounting members.

Another L-M First...

L-M's 50 Kvar Capacitor Blocks Provide Kilovars At Still Lower Costs

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors and Regulators
Line Material Industries

Only half as many units are required in substation capacitor banks when you use L-M's new blocks of 50 kvar capacitors. In addition, these blocks reduce the number of fuses, footings, and base support insulators, as well as the construction man-hours required for any given-size bank. L-M 50 kvar preassembled capacitor blocks also cost less and require about 50% of the substation area per kvar in comparison with blocks containing 25 kvar capacitors.

Capacitor Unit

The internal construction of L-M's 50 kvar capacitor is identical with that of the 25 kvar unit except for the length of pack. There is no increase in voltage stress to get the higher kvar rating. The new design is the result of continued improvement in dielectric materials and manufacturing techniques.

The tank has the same width, same thickness as the 25 kvar capacitor. Only 10 inches of additional height give you twice the capacity. It also has aluminum-metallized coating under alkyd resin paint; paragroove clamp-type terminals; strong solder-sealed bushings; and low-temperature Elemex liquid dielectric.

Factory-Assembled Blocks

L-M offers a complete line of NEMA Standard 50 kvar factory-assembled blocks from 2400 through 7960 volts—400 to 1200 kvar ratings in 100 kvar increments.

Outstanding features of L-M factory-assembled blocks include:

- Aluminum-alloy bus which is not subject to cold flow.
- Bus-mounted capacitor fuses with stainless-steel flipper to eject the leader if fuse link ever blows. Leader cannot hit live parts.
- Connections to the bus are wire brushed, and treated with oxidation inhibitor.
- Height of block is increased only 5 inches, because it is so designed that capacitors can be installed and removed from the *side*. It is not necessary to provide clearance to lift the capacitor out from between the mounting members.
- Heavy galvanized frame is jig-assembled for perfect alignment of mounting-pad bolt holes.

Prompt Delivery Now

You can save on the cost of equipment, man-hours, and space in the substation when you specify L-M NEMA Standard 50 kvar capacitor equipments. Prompt delivery . . . on all sizes and voltage ratings. Ask your L-M Field Engineer for complete information on L-M's new 50 kvar factory-assembled capacitor equipments. Or write Line Material Industries, Milwaukee 1, Wisconsin.

296-AR2

McGRAW EDISON

LINE MATERIAL Industries Elemex® Capacitors
McGRAW-EDISON COMPANY

HOW L-M INDUSTRIAL CAPACITORS GIVE A HIGH RETURN ON INVESTMENT

Raise low power-factor and reduce kilovars

...increase load capacity
...improve voltage conditions
...cut power bill

By N. K. DELANEY
Product Manager
Capacitors and Regulators
Line Material Industries

Low power-factor costs you money. With low power-factor you do not use your plant facilities efficiently. You also lose part of the electricity you pay for, because of excessive losses. Today, practically every plant has manufacturing processes with loads involving induction motors producing low power-factor. These are such loads as machine tools, pumps, fans, compressors and conveyers.

The use of capacitors improves the power-factor of the load. This reduces the KVA demand, and therefore cuts power costs. It automatically increases the load capacity of the plant circuits, and provides better voltage for equipment operation and lighting. In addition to providing better operation of the plant, capacitors can substantially reduce power costs another way: where there is a power-factor clause, based on a study of the clauses of a number of utilities, capacitors can save many times their cost.

Both Large and Small Plants Benefit

Almost every size of plant having a power-factor clause in its rate structure can justify capacitors. Studies show that it is generally advantageous to improve the power-factor beyond the maximum rate of return, because even though the rate of return becomes less, it is still economically attractive, and besides, additional system power capacity is released. A rough rule is to provide improvement to 90-95 percent power-factor.

The best way to determine the capacitor kilovars to use is to calculate the actual dollar savings for various power-factor values for your particular plant condition. See examples at left.

Location of Capacitors

The maximum benefit from capacitors is obtained when they are located

Two Examples of Savings With L-M Capacitors

These two examples are typical of the savings on power bills possible through the application of low-voltage industrial capacitors.

1. Small Industrial Plant

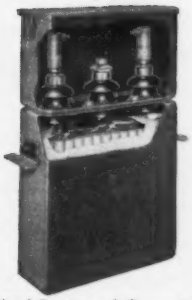
Here the rate structure included a monthly KVA demand charge, which averaged $172.28. Installation of $720 worth of capacitors cut the demand charge to $137.80, a monthly saving of $34.48. The savings will pay for the capacitors in 21 months. Here are the figures:

BEFORE Installing Capacitors		
KW	=	152
KVA	=	211
PF%	=	72
Monthly KVA demand charge.	=	$172.28
AFTER Installing		
80 KVAR of 460 Volt Capacitors		
Approximate installed cost of capacitors	=	$720.00
KW	=	152
KVA	=	166
PF%	=	92
Monthly KVA demand charge.	=	$137.80
Reduction in monthly KVA demand charge	=	$ 34.48
Number of months required to pay for capacitors out of savings in monthly KVA demand charge	=	21

2. Commercial Lighting User

Here the rate for a commercial user of a large amount of lighting equipment included a monthly KW demand charge with a power-factor penalty clause as follows: the monthly demand charge will increase 1% for each 1% the power-factor falls below 85%PF. Power-factor at the time was running around 76%. Installation of enough capacitors to bring the power-factor to 86% saved $24.41 per month, which is paying for the capacitors in 25 months. It figures out this way:

BEFORE Installing Capacitors		
KW	=	120
KVA	=	158
PF%	=	76
Monthly KW demand charge.	=	$295.66
AFTER Installing		
30 KVAR of 230 Volt Capacitors		
Approximate installed cost of capacitors	=	$600.00
KW	=	120
KVA	=	140
PF%	=	86
Monthly KW demand charge.	=	$271.25
Reduction in monthly KW demand charge	=	$ 24.41
Number of months required to pay for capacitors out of savings in monthly KW demand charge	=	25



Individual Dustproof Capacitor Unit

at the load. This is true for release of system capacity, voltage improvement, and power bill savings. On the other hand, other factors should be considered, such as load diversity, particularly when the plant contains a number of small loads. L-M engineers can help you with such problems.

Complete Engineering Service

As a large manufacturer of capacitors for utility applications, Line Material Industries offers complete engineering service on industrial capacitor installations.

Line Material development engineers will cooperate with you to determine the amount of capacity released by power-factor correction, voltage improvement, rate of return on capacitor investment, and the most advantageous capacitor location.

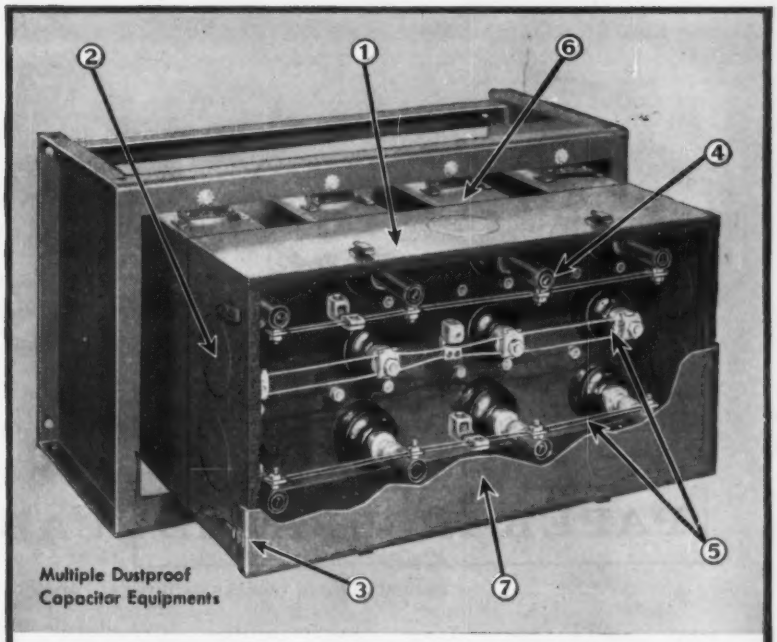
Complete Line of Industrial Capacitor Equipments

Line Material Industries offers a complete line of standard industrial capacitors, 230 to 575 volts, for installation at the motor, on the supply side of motor protective and switching devices, or at load centers.

Line Material capacitor equipments are dustproof. They can be floor, wall, or ceiling mounted. Multiple equipments are factory assembled into desired sizes, and completely wired. Installation is simple and fast. Equipments include boric acid indicating-type, terminal-mounted fuses.

Get Complete Information

Line Material capacitors may be the solution to your problem to increase load capacity, improve voltage conditions, or cut power billing. Call the nearest Line Material office for complete information and the location of the nearest distributor of Line Material equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin.



Multiple Dustproof Capacitor Equipments

NEW L-M INDUSTRIAL CAPACITOR EQUIPMENTS

Have Outstanding Design Features

1. ***Enclosure***—one-piece all-steel construction.
2. ***Knockout***—3-inch on all four sides.
3. ***Cover***—one-piece, fastened by spring clips, easily removed.
4. ***Fuses***—boric acid indicating type, terminal mounted.
5. ***Internal Wiring***—factory assembled.
6. ***Unit***—strong solder-sealed bushings with low temperature Elemex liquid dielectric.
7. ***Finish***—primer followed by one coat of alkyd-resin paint.

Available in standard three-phase and single-phase ratings, 230, 460, and 575 volts.

Sold to industry through distributors. Call the nearest Line Material office for location of nearest distributor or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

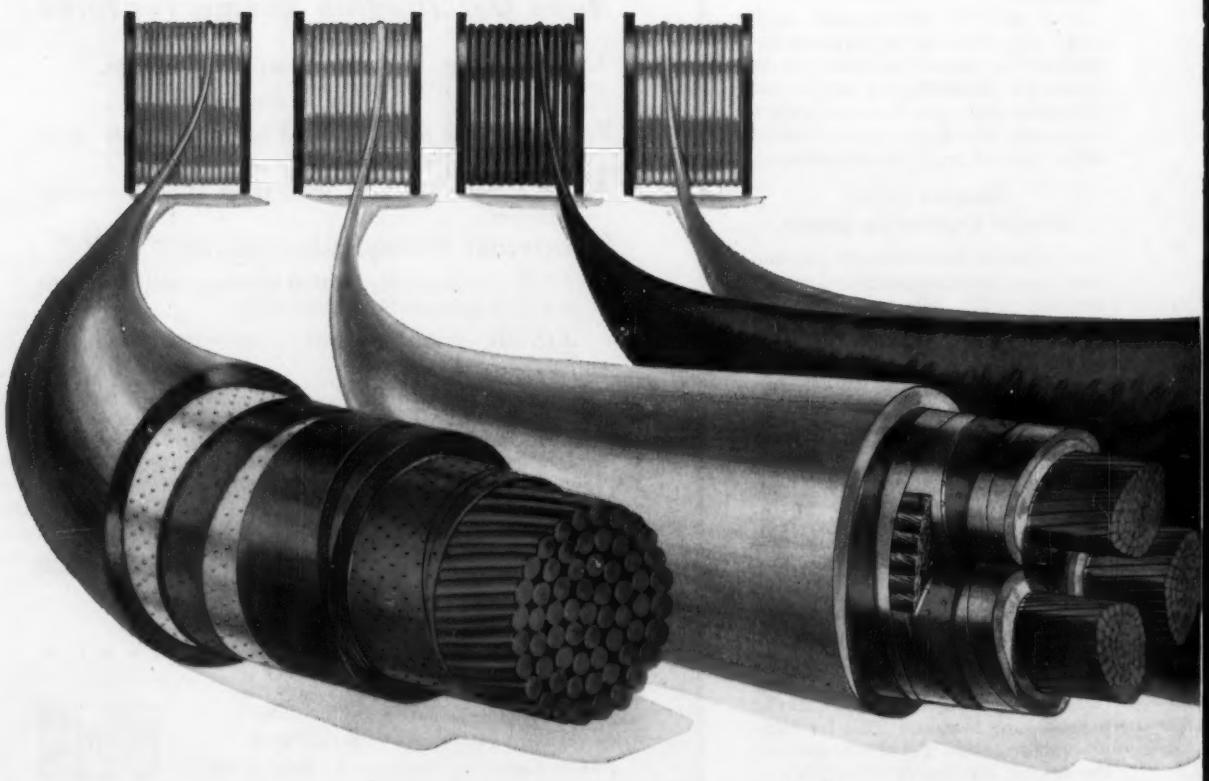
Transformers—Capacitors—Reclosers
Protective Equipment—Street Lighting
Power Switching Equipment—Regulators
Line Construction Materials—Fibre Conduit.

McGRAW EDISON

311

FOR THE MOST EFFICIENT
POWER DISTRIBUTION . . . SPECIFY

PAPER-INSULATED CABLES BY PHELPS



Single conductor, 1 KV to 15 KV

Three-conductor, 1 KV to 15 KV

DODGE!

Phelps Dodge paper-insulated power cables have a *demonstrated record* of long life in a great variety of designs for all types of applications—underground duct, direct burial, submarine and aerial.

Paper-insulated cables have these important inherent characteristics that improve operating performance and lengthen service life:

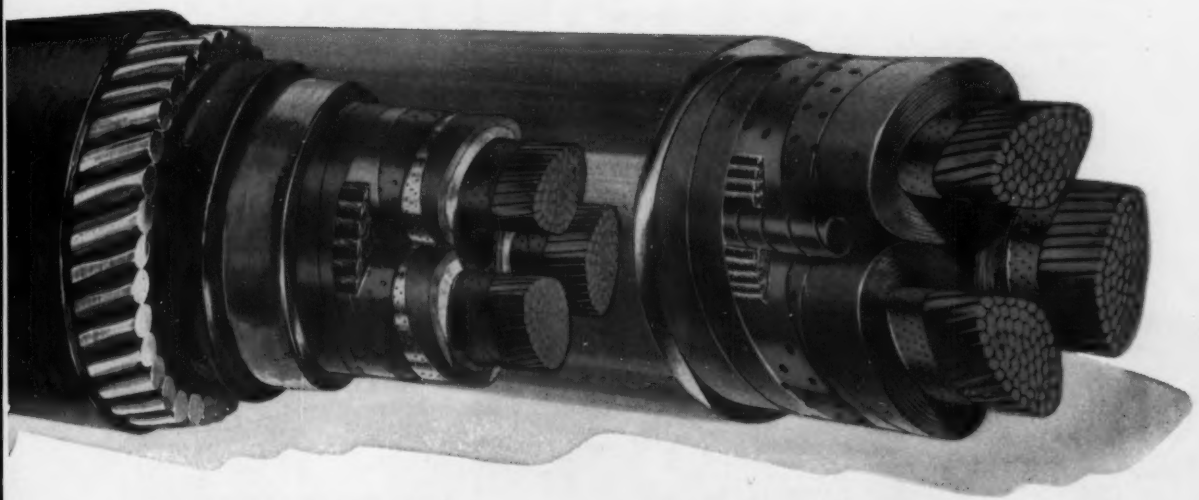
- Extra high 60-cycle and impulse strength to withstand switching and lightning surges.
- Ability to handle large blocks of power in single cables of minimum dimensions.
- Positive protection against all contaminations, due to being hermetically sealed in an extruded metallic sheath.

Paper-insulated cables can be supplied with either lead or aluminum sheaths.

Phelps Dodge offers the widest range of high voltage cables to the electrical industry.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, NEW YORK



Submarine, 1 KV to 15 KV

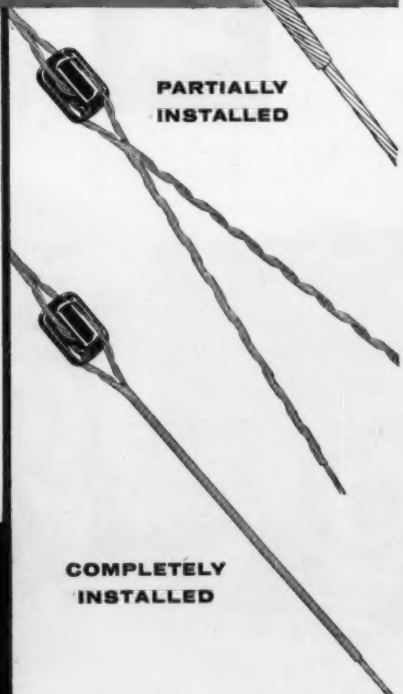
Low-Pressure gas-filled, 8 KV to 15 KV

Linemen are enthusiastic!

PLP GUY-GRIP dead-ends are the easiest, fastest and safest method yet devised for dead-ending strand.

Installation is easy because it takes just one unit, no moveable parts, no bolts or clamps to tighten. It's fast. All you do is hand-wrap the dead-end legs around the strand.

And it's safe. You can see at a glance that the installation is completed and thus secure. Linemen make better time, take pride in their work.
Dept. No. PR1C



PX-81

PREFORMED LINE PRODUCTS CO.
5349 ST. CLAIR AVE. • CLEVELAND 3, OHIO
TELEPHONE: CLEVELAND EXpress 1-3571

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

Your Westinghouse representative can prove...

YOU GAIN 12"-17" HOT LINE CLEARANCE

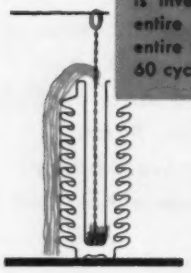
and eliminate pinched fingers with new, exclusive Westinghouse eyebolt, I-beam mounting (3-50 kva). Forged steel eyebolt seated in forged steel I-beam. Tensile strength is independent of cover. Every transformer is production-line pull-tested for 200% safety factor.

YOU CAN BE SURE...IF IT'S

Westinghouse

Jack McQuillan, Director of General Services, West Penn Power, and Don Burns, Westinghouse representative. "The eyebolt construction is a major safety improvement in pole-type distribution transformers" ... Mr. McQuillan. J-70792

100% ELECTRICAL TESTING • Soundness of head (where such a ceramic piece is most likely to be cracked) is assured by flashover test of every piece. Before plugging or assembly, porcelain body is inverted, a chain dropped the entire depth of the hole, and the entire unit subjected to a 3-minute 60 cycle flashover.

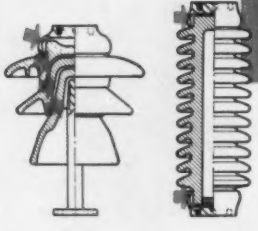


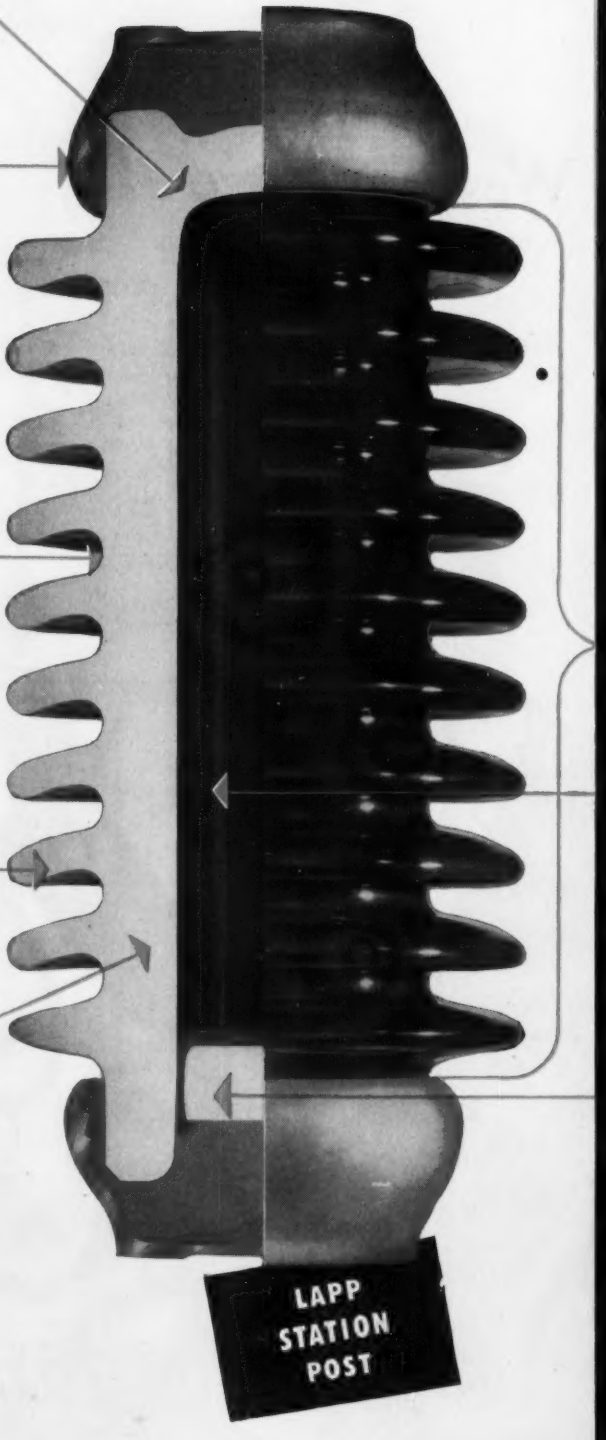
HARDWARE EXTERNALLY ATTACHED • Bases and caps are cemented ON. Porcelain is loaded only in large-area low-intensity compression grip; this eliminates the cause of insulator cracking.

UNIFORM LEAKAGE PATH • Leakage distance secured through multiple short petticoats—*Lapp fog-type design*. Flanges are spaced for natural cleaning action of wind and rain—avoid concentrated hot-spots where local stress can precipitate flashover. This is also the ideal surface for horizontal mounting of insulators.

SHORT STURDY PETTICOATS • Protect body from impact or flashover. Will withstand much more severe attack than required to crack shell-type units, yet will finally break off clean and leave body undamaged.

RIGID UNDER DEFLECTION • One piece porcelain body. No nested porcelain parts, no internal pins, studs or inserts—no internal forces to load porcelain in tension.





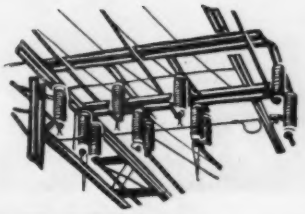
The service record on switch and bus insulators on any major system will show the superiority of Lapp Station Post insulators. Since 1931, these units have been handling dirt conditions, lightning flashover, mechanical shock and loading—with fewer outages, and at lower maintenance and replacement cost, than any other type of station insulator. One reason, of course, is the basic superiority of the design—the Lapp conception of giving mechanical as well as electrical responsibility to a column of porcelain. The other reason is that *Lapp knows how to make 'em*—how to take advantage of the special strengths of porcelain and avoid its weaknesses. The result is the Lapp Station Post; it will improve service and save money on *your* system. Lapp Insulator Co., Inc., Le Roy, New York.

. . . THE INSIDE STORY

of Station Post reliability

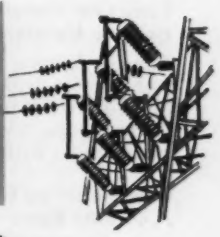
"STRAIGHT-LINE" FLASHOVER • Live terminals are separated by full length of insulator; flashover goes *outside* the unit. Loss of one or more petticoats does not reduce flashover distance.

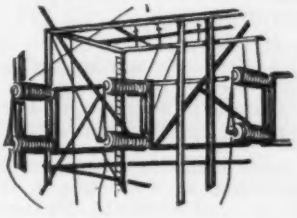
INSIDE GLAZED • All Lapp Post porcelains are glazed inside and outside—a Lapp extra-quality feature that makes for added cleanliness and more critical visual inspection.



PERMANENTLY PLUGGED PORCELAIN • *After thorough electrical testing*, porcelain body is plugged with porcelain and natural rubber—a Lapp design that has stood the service test of 20 years. This assures a permanently clean, dry hole; avoids internal conductive contamination.

SAME STRENGTH INVERTED • Mount 'em upright, obliquely, horizontally, or inverted—mechanical and electrical characteristics give a safe margin of operating security.





Lapp

NEW MOTOROLA T-POWER 2-WAY RADIO

Transistorized Power Supply for both receiver and 25-watt transmitter

Long Life Transistors Replace the Vibrator . . .
Reduce Maintenance and "Down-Time"

Already famous for the lowest maintenance and operating costs in the 2-way mobile radio field, Motorola mobile radio is an even better investment now—with the T-POWER unit. The vibrator is gone! . . . replaced by rugged long-life transistors. Gone, too, is the problem of frequent vibrator replacement. Here is a mobile radio with an all-electronic power supply.

New Mounting Flexibility with Plug-In Control Head
. . . Same Basic Unit can be Used for Front or Trunk Mounting

With the T-POWER radio, you are no longer restricted to one type of mounting. Install the complete radio, with drawer unit and plug-in control head, for under-dash mounting. For rear mounting the same basic drawer unit can be installed in the trunk and connected by cable to a dash-mounted control head. And—the same basic drawer unit can be interchanged with the equivalent Motorola Twin-V trunk mount radio models operated from a 12-volt negative ground source.

T-POWER radio is another example of Motorola's continuing leadership in the practical application of transistors in mobile radio. Other tested and proved transistorized products include the Dynamic Microphone and Power Voice Speaker.

Get all the facts.—Write now for literature with complete information.

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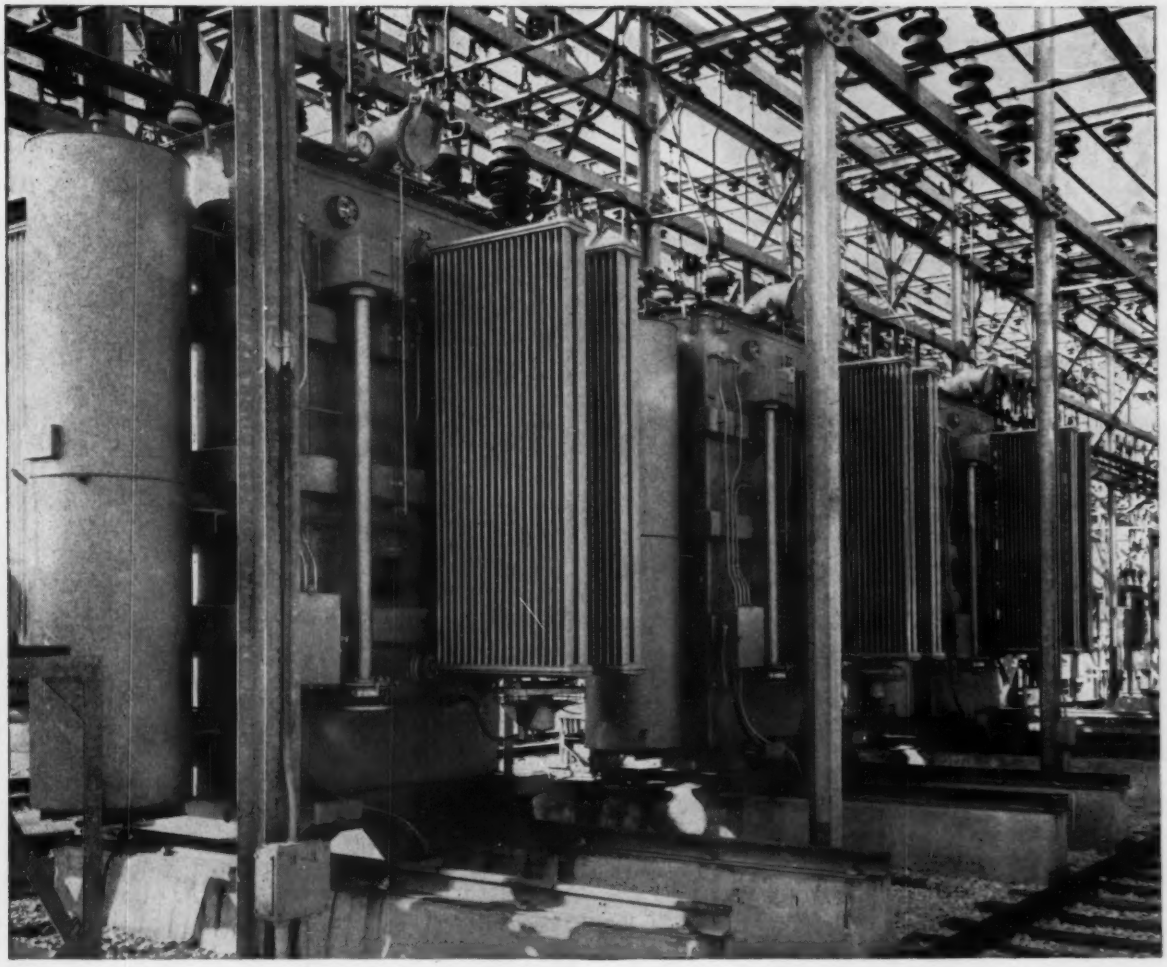


KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

"More power! More Kuhlman! —for Memphis . . ."

"The far-sighted planning of Memphis, Tenn., is a model for all the booming South . . . take the story of Substation 11 (shown above) for example:

> "Last year, 6 Kuhlman 3333 KVA power transformers had been satisfactorily carrying an increasing load. However, Memphis Light, Gas & Water's division engineers—carefully appraising the movement of new industry into Memphis and projecting this trend into the future—decided to install 6 new Kuhlman 5000 KVA units. The result . . . more reserve output for the present—flexibility for the future.

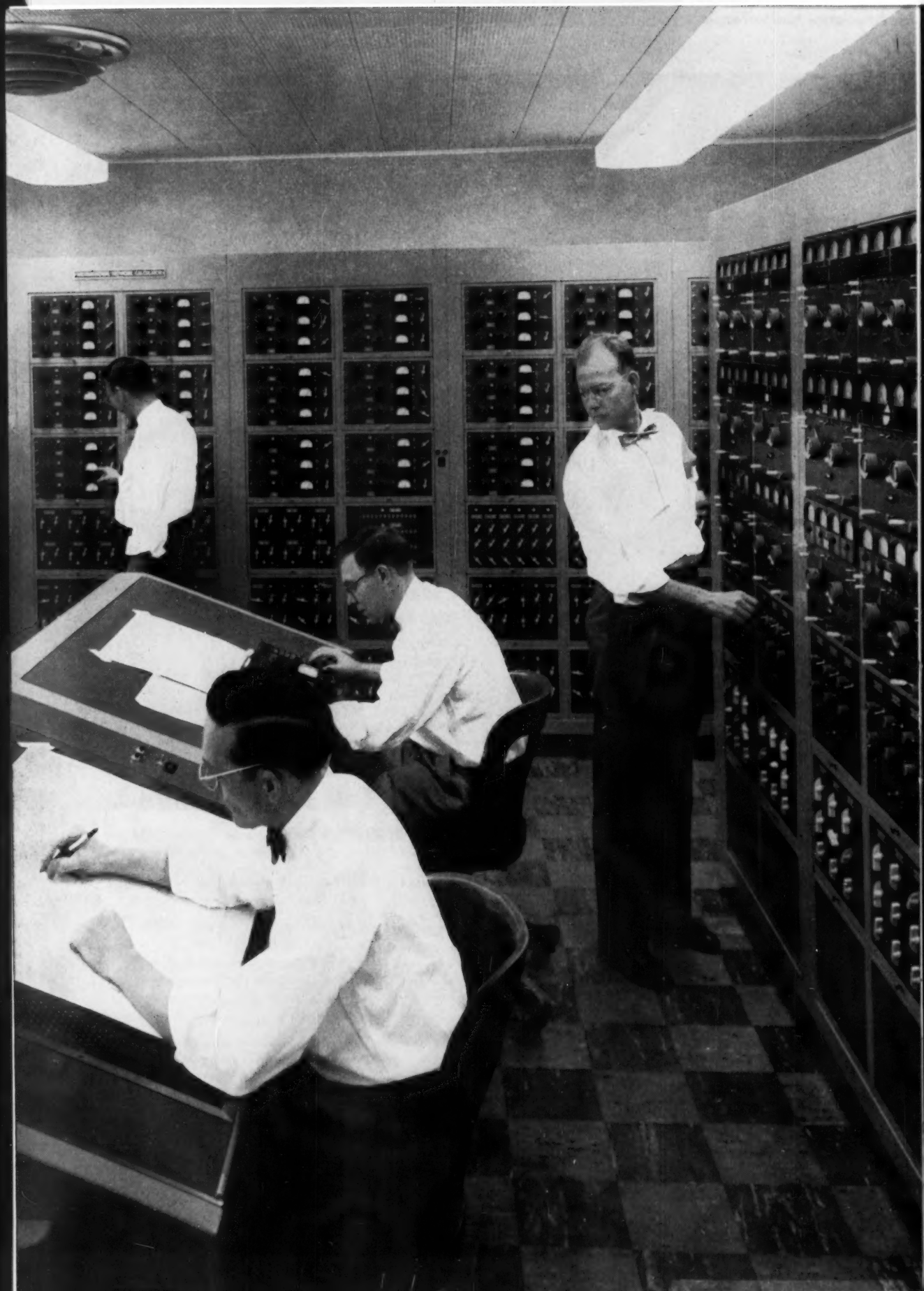
"This confidence that growing Memphis places in Kuhlman dependability has been won by satisfactory performance. Before planning your next expansion move, let your local Kuhlman representative show how our 63 years of experience can profit you."

5715b

KUHLMAN ELECTRIC COMPANY

GENERAL OFFICES: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA



Helping the Industry meet its growing loads

The creative abilities of 750 engineers unshackled each year

Each year, Westinghouse "machines that think" have been taking over more and more tasks that steal an engineer's time. Performing calculations in less than 1% of the time required by the engineer, these machines give him more freedom for creative planning.

This year, again, computer facilities in the Analytical Department at the Westinghouse East Pittsburgh works are saving utilities over a million and a half hours in engineering time . . . unshackling for a year the equivalent of 750 engineers.

These extraordinary facilities—developed by Westinghouse—are doing tomorrow's planning today . . . planning power transmission systems far into the future, solving the complex problems of automated power plant operation. Computer studies solve problems which, because of the time factor involved, have never before been economically practical for thorough study.

These modern research tools will save weeks, months, even years, over the time it would take to solve your system problems by ordinary means . . . another example of Westinghouse leadership in helping the utility industry meet America's growing electrical load—faster and more economically.

J-97210

YOU CAN BE SURE...IF IT'S

Westinghouse

'HIDDEN' EQUIPMENT—There's a five-state power network in this picture, complete with generating stations, power lines, homes and factories. When this picture was taken, the calculator was "answering" questions about a future power network. Seated at instrument desks, W. E. Furniss (left) takes down "answers" read by L. J. Rindt. R. W. Smith, West Penn Power Company engineer, looks on. In the background, R. H. Swanberg, Chief Operator of the calculator.

A-C Network Calculator

Foremost among the machines serving the utility industry at the East Pittsburgh works is the world's largest a-c network calculator, with 36 generating stations and 580 circuits. This electronic marvel simulates every part of an actual power system—transformers, generators, transmission lines and loads—and is used in studies of very large systems.

Ranking high in importance of the studies performed on the a-c calculator are those of power system planning. In general, these fall into three classes:

1. *Load division or voltage regulation studies*—generator power factors, location of system components for best over-all results, system losses, location of new system components.

2. *Transient stability studies*—power limit of lines or portions of a network, optimum switching time for faults, effect of various bus arrangements.

3. *Short-circuit studies*—breaker duty, effect of different methods of grounding, both phase and ground short-circuit currents, mutual coupling and ground current—inductive coordination.

Other Computers

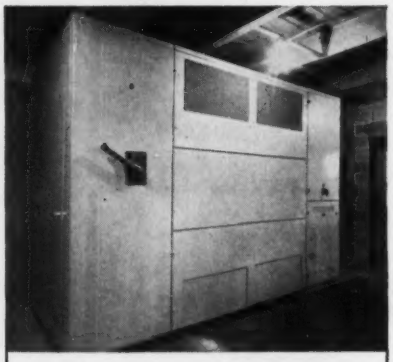
Other Westinghouse aids to economic power generation and distribution include digital computers, analog computers, electronic differential analyzers, and the d-c calculating board. The Analytical Department is fully staffed with men thoroughly experienced in programming information for virtually every type of study which can be made with these machines.

Nation's most modern air terminal served by power from Wagner Transformers!

The "Spirit of St. Louis" is reborn in the city's newest symbol of the air age—the dramatic new terminal at Lambert-St. Louis Municipal Airport. Built at a cost of $7,728,000 and dedicated in 1956, it's the most modern in the nation.

Electric power for this terminal is distributed by five secondary unit substations, rated from 300 to 1500 kva. These were manufactured by Nelson Electric Company and equipped with safe, dependable Wagner dry-type Transformers. Wagner dry-type Transformers are carefully engineered to provide an uninterrupted flow of power—built to stand up under rigorous 24 hours a day schedules. Wagner pioneered in the development of dry-type load center transformers, and the Wagner design is known for its great electrical stamina and mechanical strength.

Wagner dry-type unit substation transformers can answer your power needs just as they do at Lambert-St. Louis Municipal Airport. They are "Predesigned"—coordinated with the specifications of unit substation builders to save you job engineering, time, and cost. Consult the nearest of our 32 branch offices, or write for Bulletins TU-205 and TU-214 for full information.



This is the Nelson main substation at the St. Louis Airport. It is equipped with a 1500 kva Wagner Dry-Type Transformer.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

...to help America LIVE BETTER—*Electrically*

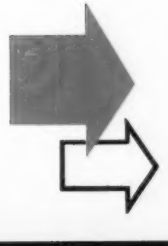
LIVE BETTER ELECTRICALLY

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

WT57-9

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

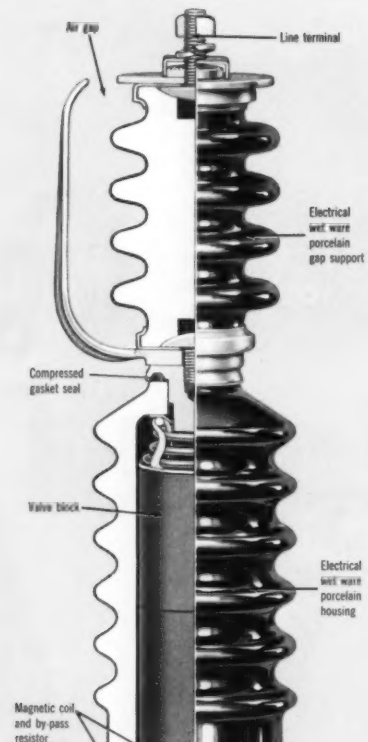
A COMPLETELY NEW Distribution Lightning Arrester ··· Unlike Anything In Its Field ··· Is Described on the Next Page



A New Approach to Distribution Arresters

Dynagap element of Thorex distribution lightning arrester. This identical assembly is used in all grades of new Thorex arresters, including heavy-duty station types for 230 kv and higher service. This imparts a degree of ruggedness entirely new in the distribution field.

Thorex Dynagap First to Use Rugged Station Type Essential Parts for Distribution Service



Operating parts of a new Thorex Dynagap distribution arrester. This model is equipped with an external series air gap. Another similar model uses an internal series gap and an automatic ground lead isolator.

Invention of the extremely small and efficient Dynagap for Thorex high-voltage lightning arresters has opened the way to further development -- an entirely new distribution arrester with unheard-of features.

Never before have identical vital parts been interchangeable between maximum-duty station type and distribution type arresters. The compact new Thorex Dynagap has made this possible. It brings to the distribution field both principles and performance of an entirely new order.

Because of its inherently rugged station type elements, this arrester is exceptionally effective in dealing with the heavy lightning discharges typical of un-shielded distribution circuits. This is coupled with complete freedom from the influence of fault current magnitude at the arrester location. Its 60-cycle follow current interrupting ability is not limited by either maximum or minimum system fault currents, thus giving it a universal field of application. It may be used interchangeably at high power locations or those of low power and high lightning incidence.

Influence of station type design goes beyond the use of the same essential series gap parts. Performance of any arrester, regardless of type, is highly dependent upon the permanent exclusion of moisture. Sealing practices common to the heavier-duty Thorex arrester models are used in the new distribution series. Maximum gasket efficiency is assured by the same system of spring-pressure-follow sealing used with such excellent results in larger Thorex models.

As will be explained briefly on the next page, the radically altered ratio of power-follow current limitation between the series gap element and valve blocks, by action of the new Dynagap, opens-up a fruitful field of technical improvement. Many important functions can now be "tailored" to the special requirements of distribution service. This is one of the greatest advancements ever made in arrester development.

You will hear and read a lot more about this striking development in coming months. For still better knowledge, however, gained on your own terms, install a few sets right away. Pick spots where arresters never could -- or never have -- worked before. Then you will know, firsthand, the real importance of the new Dynagap.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

Dynagap Applies Advanced Principles to Lightning Arrester Operation

Ingenious Gap Performs Major Portion of Valve Action—Permits Radical Valve Block Improvements

After lightning action of a valve type arrester, 60-cycle follow current continues to flow. This is extinguished by the combined current-limiting function of the series gaps and valve blocks. Until recently, the blocks supplied 98 to 99 per cent of the necessary resistance.

Magnetic arc blow-out, pioneered in 1953 by the Thorex high voltage arrester, added a degree of "valve action" to the gap performance. By stretching and cooling the arc, high arc resistance was built up in the gap. This permitted the gap to assume about 10 per cent of the total resistance in the arrester circuit.

When valve blocks supplied 98 to 99 per cent of the required resistance, this predominant duty ruled their composition. It forced compromises with other recognized modern necessities -- primarily, high durability under severe long duration surge current discharges of natural or system origin. Improvements introduced by Thorex arresters in 1953 materially relieved these restrictions on valve block composition and resulted in strikingly better performance.

Observing these facts, O-B development engineers were fascinated with the possibilities of a more radical alteration of the gap-to-block resistance ratio. After three years of intensive research, the Dynagap has evolved. Originally it was designed to meet the pressing demands of heavy duty, high voltage station service, but its drastically reduced dimensions adapted it to distribution application where it retains many of its basic station type characteristics, and imparts unheard-of performance to distribution grades.

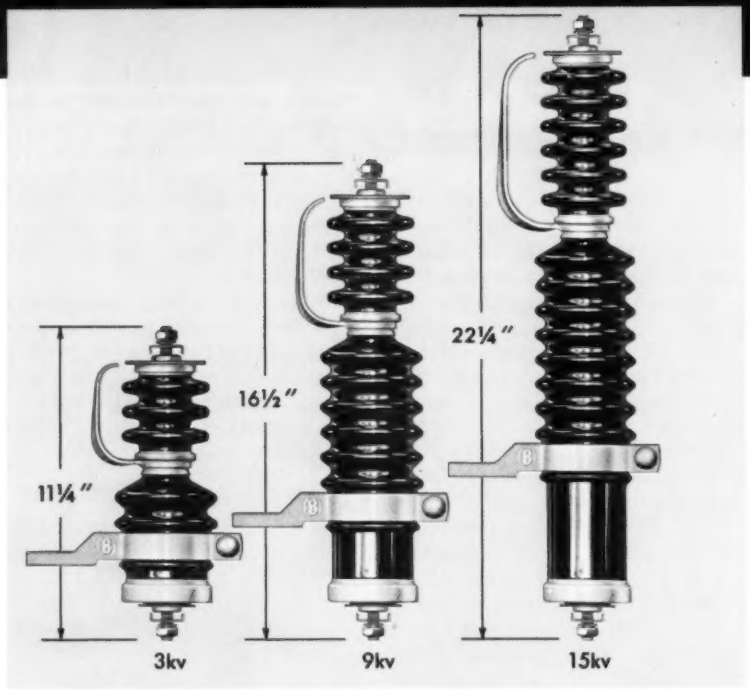
Applied to new Thorex distribution arresters, the Dynagap supplies 30 to 40 per cent of power follow limiting resistance. As a result, many restrictions have been removed from valve block development, and new blocks can be "tailored" to the specific requirements of distribution service -- an advantage never before possible. The result is an entirely new conception of distribution arrester -- an entirely new order of balanced design and performance.

Never before has a distribution lightning arrester used the identical essential parts of high voltage station type models. And, never before, have such outstanding qualities been offered in the distribution field.

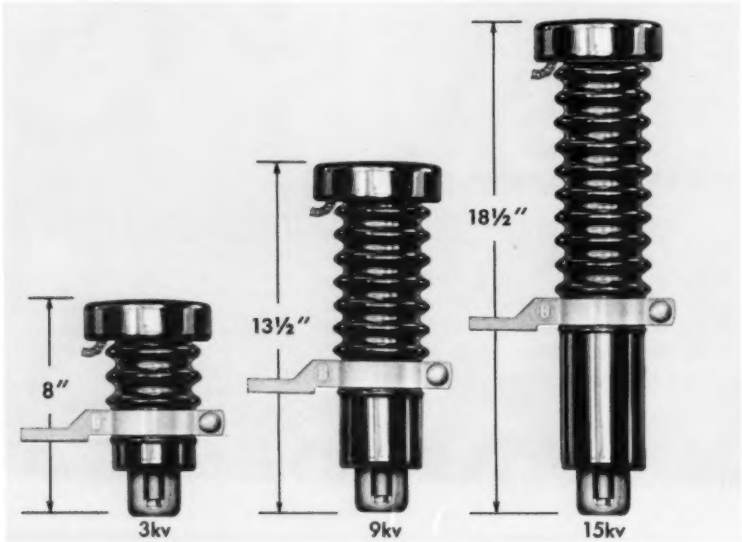
Opening the Dynagap structure reveals a series of thin Mycalex plates, mechanically interlocked for stability, compactness, and arc restriction. Each plate contains one gap electrode on either side, riveted through for series connection. By a system of precise indexing, these electrodes are positioned for proper gap spacing when the stack is assembled. The structure shown is for an arrester operating at 13.8 kv. It has 13 plates and 12 sets of gaps, and is capable of stretching the arc 33 linear inches. It is this great stretching action that builds-up high arc resistance and contributes an important share to power-follow current limitation; simultaneously relieving the valve blocks of this portion of duty.

Operating parts of the Dynagap. Magnetic coils above and below the gap element, when energized, drive the follow current arc away from the initial spark gap and into the arc control chambers. In this way the arc is stretched 140 times its original spark gap length and high resistance is built-up. Connected in parallel with the coils, in their centers, are by-pass resistors. These are small discs of valve block material having highly non-linear resistance. When lightning impulse occurs, the high inductive impedance of the coils and the low resistance of the blocks at elevated voltage result in passing this discharge through the resistors, across the close setting of the gaps, through the main valve blocks, and to ground with resulting exceptionally low IR discharge voltage. Follow-current at 60-cycle line voltage is presented with a high-resistance state in the non-linear by-pass resistors, but readily passes through the coils. This creates a strong magnetic field that drives the arc, builds high arc resistance, and leads to extinguishment.

New Dynagap Permits Size Reductions Down to Half That of Other Distribution Arresters



Typical Thorex Dynagap distribution lightning arresters. Line-to-ground ratings of both types graduate from 1 to 18 kv. One group is typified by an external air gap in series with the arrester in order to follow distribution practice of having the arrester completely disconnected from the circuit while not operating. The second group is likewise equipped with a line lead and a series gap contained within the arrester housing. This type also features an automatic ground lead isolator that frees the arrester from the circuit in the event of some damaging accidental overload. Since such conditions always result in instantaneous high heat, this is used to discharge a small explosive rivet that blows the ground connection clear.



● Dynagap distribution lightning arresters set a new standard for reduced size--a quality greatly welcomed by many users. Compared to any other arrester now manufactured, types above 3 kv rating range from 10 to over 50 per cent smaller. Greatest reductions are in higher voltage ratings where dimensions are more of a factor.

While radically miniaturized, the Dynagap distribution arrester uses vital operating parts interchangeable with highest-duty station grade Thorex models. Such a combination of reduced size with other unheard-of essential features makes this new arrester unique in the distribution field.

Among other advantages, the new Thorex distribution types -- with all their advanced features are available at no price premium.

Start now with your first installations of Thorex Dynagap type DV arresters on your distribution circuits.

OHIO BRASS COMPANY
MANSFIELD, OHIO

Ohio Brass

4776-H

EDITORIALS

The Sun Has a Place in Our Power Future

We engineers occasionally find ourselves following the propensities of the ladies and concentrating on being stylish. Often these days there seems to be nothing worse than being out of style. In the utility field, for example, no one is truly fashionable today unless he displays the technical garb of nuclear energy—uranium, thorium, deturium, fission, and fusion—in all their fascination and mode. Yet there are other technical fields that invite engineering exploration just as cordially.

On page 62 Theodore Baumeister, Stevens Professor of Mechanical Engineering at Columbia University and well-known consultant in utility engineering, scans one of these—the field of solar energy.

Certainly in the light of history and the feeble attempts that have been made to date to harness the sun, this is not a popular subject. Despite this background, however, Professor Baumeister finds in solar energy certain fundamental facts which engineers would do well to bear in mind.

Baumeister points out among other things that steam, hydro, internal combustion, nuclear and solar energy are complementary as well as competing methods of generating power. The best costs and reliability, he says, generally stem from the diversified use of alternate sources. He warns that the era when power systems could be exclusively tied to one form of energy—whether steam, hydro, or whatever—is largely obsolete.

"But with solar power plants—given better electrical transmission—there is no fundamental reason why a source 1,000 miles away could not be used and tied in with hydro, steam, nuclear, and pumper storage plants to meet night loads and the vicissitudes of weather, climate and latitude," he says, adding: "The interconnection potentialities must not be forgotten as a step in the direction of harnessing solar energy."

The essential point is to recognize the magnitudes and potentialities of solar energy and to ask with Professor Baumeister: "Why don't we do something about it?"

Do We Want the Water Heating Business?

To an outsider this question must seem absurd. It's a little like asking whether we in the electric utility industry want more business, or for that matter, whether we want to *stay in* business.

But it is not an absurd question. The electric water heating business is sick today, and has been for the past several years. It is a sickness that comes from indecision, inconsistency and vacillation. But before the cure comes the question: Do we want to get well? Do we really *want* the water heating business?

If the answer is "Yes," then we must face facts. And the facts are that this part of the electric service business is being slowly strangled by a tangle of outmoded rates and demand charges and a complexity of tank and element sizes, local codes, and federal restrictions. This snarl stands between us and what the customer wants . . . hot water!

We must supply this service. We must do it on a satisfactory, salable basis. We must meet, and beat, competition in this area *now*! Promotion of all electric living has carried us far beyond "the point of no return".

• Take the all-electric home. It is a goal toward which we have been striving for years. Without satisfactory, salable water heating service this dream of a better way to live is not only incomplete, but impossible and unthinkable.

• Our Live Better . . . Electrically program, among others, must include electric water heating. Exclude it and the punch is gone . . . and with it much of the meaning.

Moreover, Mrs Customer needs more hot water today than ever. You and I know her well enough to know that she's going to get what she wants, when and where she wants it and pretty much on her own terms . . . and today she's in the hot water business, regardless of what we do!

If we want our share of her business—a richer, bigger and more profitable share—we had better provide her with a more-satisfactory, more-salable electric water heating service than we are now.

3kv 9kv 15kv

Buyers Sit Tight As Prices Rise

- **Utility purchasing agents say new round of price rises spurred very little advance buying**
- **They expect that more increases will follow along pattern already set, but doubt all prices will hold**
- **Spending slowdown, brought about by financing delays, trims inventory and cuts "some necessities"**

The July round of price increases on electrical equipment caused little more than a ripple in utility buying, although the rises seem to have been generally anticipated.

Utility purchasing agents look for more price hikes on the material and equipment they buy, but think manufacturers will have trouble making all the new prices stick.

A hold-down on spending serves to trim inventories, postpone some construction. This is brought about by financing delays as utilities watch for easing of the money market.

These are some of the conclusions gleaned from recent talks with seven purchasing agents from representative utilities scattered around the nation. As might have been expected, there was some griping about the recent equipment price increases, but one of the more aggressive PAs called the recent round "rather moderate." He quickly added that cumulative increases over the past few years run "rather high."

Ordering Has Been Cautious

Only two of the seven purchasing agents interviewed indicated that the July price rises had inspired any pre-increase buying. Said one, "We managed to keep our nose above water. We had information some time ago of the coming price increases so we didn't have to come into the market at the last minute." The other said, "I ordered ahead only for projects that were definite. I did buy some items, including a turbine." He added that several salesmen were still holding pre-July prices open for him several weeks after the price boosts were to have gone into effect.

More typical was this reply, "We haven't ordered anything speculatively, but we have corraled anything that was pending. You can't just order for the sake of ordering—not with money still costing something like 13% per year." And three of the utility buyers said flatly, "We've done nothing" about the July round of price increases.

Slowdown in Spending

Of more significance to utility buying than the price increase is the current hold-down in spending. This is brought about by delays in financing as top management attempts to "sit out" the current high interest rates.

Not only has this "tight money situation," as the PAs call it, brought some trimming of inventories but it seems also to have postponed projects in some cases.

Buyer for a consulting and construction firm gives this view: "This 'tight money' period has caused some work to be delayed. Some utilities end up by trying to skimp on a job. 'Cut this out and that out,' they say. But they're getting below the bare necessities."

More typical was this reply from a utility PA: "We have a very tight condition on increased demand so we can't hold back much. However, we are clamping down drastically on inventory. We're covering ahead no further than we have to. Our inventory is about the same as last year at this time.

Another says, "We've cut back a bit on the window-dressing—right-of-way clearing for instance. And we're coasting on inventory. All the fast-moving items are on a 30-day basis."

But two of the seven buyers interviewed said 'tight money' had no effect on their purchases. "We have no choice," said one. "Population growth in our territory has been so great that we have to buy in advance. Tight money hurts, but we can't help it." The other says he has been using up a backlog of inventory accumulated over the past two years.

How Increases Were Received

Pretty much down the line there was harping about the new round of price rises. A moderate summed it up this way: "We question any and all increases. But it seems to be the general thing—this merry-go-round of wages and prices. You have to ask this, though: 'Is the increase caused by the rise in steel prices or is this just a convenient time to boost prices?' I suspect it's tied to both."

Price Hikes Will Be General

The purchasing agents agreed almost to a man that the price increases will be across-the-board on nearly all items. But there was considerable argument as to whether the new prices will stick at announced levels. One purchasing agent said he looked for some book price shading "when it comes to actual quotation." Some saw the equipment market as "relatively soft" at this particular time. But one firmly disagreed. Said he: "This seems to be a firm market as far as utility equipment is concerned. We have little choice as to whether we will buy and what we will buy. We have to meet demands. It's certainly not soft except maybe for a couple of spots. Big equipment has a very firm market. Switchgear, on the other hand, was a little sloppy not long ago."

Upturn in Transmission

Two of three PAs queried on recent downtrend in heavy transmission equipment buying look for upswing in orders by end of the year. The third sees heavier buying in this area next year. One said the situation reflected inventory trimming. Another said he couldn't explain recent downtrend but was cognizant of it in his utility.

When the H-Bomb Hits—CD Alert

CD "very well pleased" with response of electric utilities, but communications and identification still pose problems; solutions would be more difficult if real H-bombs fell

Electric utilities' participation in "Operation Alert 1957" won praise from the Interior Department. But communications problems that developed around the nation during the imaginary thermonuclear blitz showed more work necessary.

On July 12, a theoretical 167 atomic and hydrogen bombs fell on the U. S. Ranging from 20 kilotons to 20 megatons, they "devastated" 155 major cities and sent the utilities into "feverish activity" to keep power flowing.

By the end of the week the smoke had cleared, and Edward D. Frye, special assistant to the Under Secretary of Interior, who ran power operations during the exercise, said: "We are very well pleased with the way electric utilities responded." From regional Civil Defense headquarters came reports that this had been the "most successful" alert.

Weaknesses Cited

Nevertheless, the object of the exercise was to find weaknesses, and some were found. The most serious were in the field of communications. Overworked land lines, knocked-out radio relay stations, and confusion in radio frequencies hampered "rehabilitation" in most areas.

Another weakness concerned identification. Kansas City Power & Light Co pointed out that during the real tornado which hit the outskirts of Kansas City on May 20, company officials had trouble getting into the disaster area because they could not convince police and National Guardsmen of their identity.

Capacity Remains Adequate

One expected difficulty did not arise. Electric facilities proved tougher than customers, and although losses in generating capacity were large, power was adequate to serve areas that remained habitable.

Decentralization eliminated some tie-ups. Department of Interior divided the U. S. into 16 power areas mapped out on the basis of interconnected systems, and placed a utility vice-president or power pool coordinator in semi-autonomous control of each. These area power directors united existing power pools in each area into an entity for rapid emergency interconnection. Meanwhile local utility executives maintained liaison with CD authorities.

The amount of realism and extent of the problem varied. Some cities played fallout problems and went into logistical problems. Others concentrated on communications, where improvements are most needed.

Here are reports from around the nation:

In Chicago . . .

Six of Commonwealth Edison Co's 12 generating stations, about 60% of capacity, were "damaged." All but 5% were expected back in service within 10 days, with the remainder back in 6 months. Transmission facilities were 10% "damaged." Company felt capable of supplying all demands that remained after attack. A two-man liaison team stayed in the CD control center. Commonwealth Ed Co says that dispersion was responsible for the relative lightness of "damage."

In New York . . .

Southern half of Manhattan, part of Staten Island, and all of Brooklyn were "devastated" by the blast and heat. Residual radiation would have prevented any consumption of electricity in this area for some time. Capability remaining after the "attack" was 1,358,000 kw. Interconnections with Niagara Mohawk and Long Island systems boosted power to 50% of normal, which was expected to be sufficient. Where structural "damage" was slight, Con Ed Co expected service to be renewed within a few days. The company kept representatives at each borough CD headquarters, and operated a damage control staff out of Manhattan.

PLUG-IN ALARM, made by Midwest Research Institute, was not tried out in alert as it is still being tested

In Atlanta . . .

Georgia Power Co says the alert there was largely an exercise in communications. The company telephone system was used to relay messages. Liaison officers were sent to regional CD headquarters in Thomasville and state headquarters in Atlanta. The company feels coordination was adequate, but regretted the loss in realism when telephone messages sometimes had to be relayed through towns hit by bombing.

In Seattle . . .

CD umpires in the Puget Sound area joined Seattle City Light officials in recommending that local power companies help set up more realistic situations in future alerts. Utilities attacked the problem energetically and in detail. They planned for refueling of service trucks and long-term food supply for crews as well as rerouting circuits and using their own communications. Telephone facilities were overburdened, they found. By cancelling maintenance shutdowns, Seattle City Light Co supplied 340 Mw surplus to help replace lost Columbia River generation.

In Dallas . . .

Texas participation was limited by previous natural assaults. After three days, companies returned to the more urgent problem of cleaning

up the aftermath of spring tornadoes, floods, and Hurricane Audrey. Southwest Power Pool officials called communications their worst problem—shuffling mobile radio units to bridge bombed out areas. They also recounted how repair crews who came in from several states following "Audrey" were hampered by lack of a common operating frequency for their radios. The "bomb" that hit Dallas "wiped out" Texas Power & Light Co's office force and central dispatch system, but control was assumed by four district substations.

In Kansas City . . .

Kansas City Power & Light Co's 32 story headquarters was "totally destroyed." Coordination with CD officials was considered adequate, after headquarters were reestablished. The city exchanged power with St. Louis and St. Joseph, and more rapid identification of utility men was much discussed.

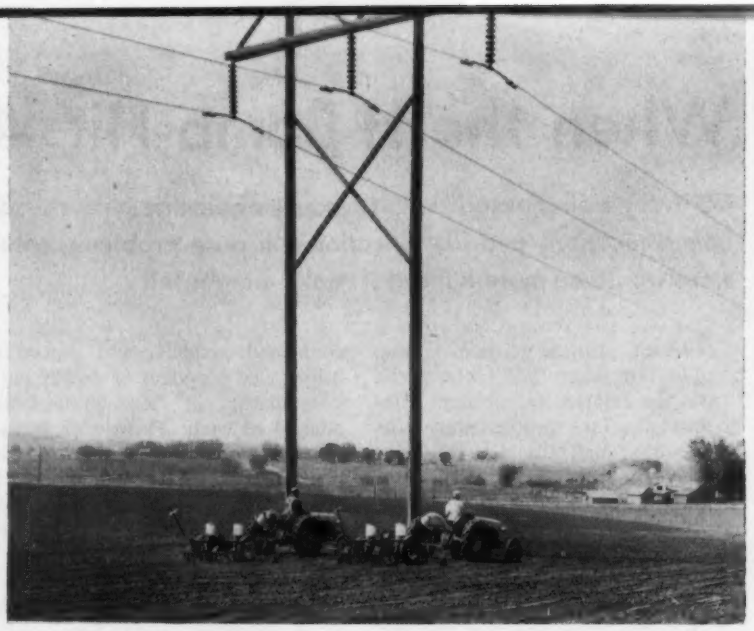
In St. Louis . . .

Union Electric Co's alert board was confronted with a real emergency when a Civil Air Patrol plane crashed into a power line during the exercise. A "five-megaton bomb" knocked out only 10% of Union Electric Co's generating capacity. Real and hypothetical emergencies both went smoothly. Remaining power sufficed to fill the need.

In Los Angeles . . .

Southern California Edison Co and Los Angeles Department of Water & Power were "almost totally destroyed" by two H-bombs. The complete devastation rendered all plans insufficient to cope with the disaster. City was too contaminated by fallout to attempt early restoration of service. 70% of So Cal Ed Co's generating capacity was destroyed. The hardest-hit city in the U. S., Los Angeles received a dose which might closely approximate the real thing, when and if it comes.

National results show clearly that much progress has been made, but complacency is not warranted. If World War III starts with an attack similar to this imaginary one, clean-up probably will be hampered by additional raids. "Operation Alert 1957," however, marks a step in the right direction by both CD and the power industry.



R/W Film Helps IP&L in Court

The photo above is typical of the scenes shown in an Iowa Power & Light Co movie which, as an item of evidence in condemnation hearings and appeal trials, is favorably influencing jurors and condemnation commissioners.

The 40-min, 16-mm color film, which cost $1,500 excluding employee overhead, stars farmers who operate machinery around and sometimes right between 161-kv H-frame poles. "The picture definitely shows that the conventional two-pole structure does not, even under the most haphazard farming practice, take more than one- to two-tenths of an acre out of cultivation," says Thomas N. Wright, Iowa P&L attorney.

Film Answers Charges

In cases heard before the movie was made, landowners and their attorneys consistently charged that H-frame structures were hard to farm around. A pair of poles, the complaints said, took from one to five acres of land out of cultivation, particularly when the H-frame was diagonal to section lines.

The company decided to sponsor the movie in 1955 after it began right-of-way buying for the first leg of a 135-mile, 161-kv line. This line included some diagonal runs comparable to ones experienced in some 200 miles of high-voltage H-frame transmission line built before 1955. "Specifications on the new line were the same as on previous lines, as were the property owners' complaints," Wright observes. "As the right-of-way work moved forward, it became evident that a number of the condemnation awards which had been appealed would have to be tried."

The company reviewed landowners' allegations of damages and the law of evidence. It formulated basic elements of policy and strategy to be followed in handling the appeal cases. And the movie on farming practices was one result.

Employee Directed Film

The film was taken during the 1956 crop season. An employee with farming background served as director for an independent photographer. The two toured existing lines and arranged for farmers to call in when machinery was going to be run near the line structures. When the time arrived each farmer was asked to handle the equipment exactly as he would normally.

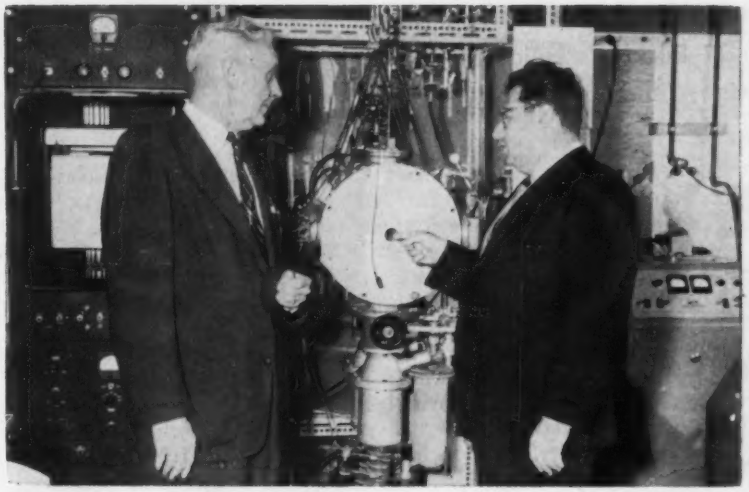
"The picture has been used in five appeal trials to date and three original condemnation hearings," says Wright. "At the trials the presiding judge heard arguments of the opposing counsel out of the jury's presence and ruled that the picture was admissible with the landowners' attorney having the right to cross-examine the company 'director.'"

San Diego G&E Backs Fission Research

San Diego Gas & Electric Co has joined the parade of electric utilities participating in research programs on nuclear fission power reactor systems. The company will join forces with the General Atomic Division of the General Dynamics Corp of San Diego in sponsoring development of economical nuclear power reactors, according to Pres Emory D. Sherwin, San Diego G&E.

Mr. Sherwin said participation in General Atomic's program would involve not only technical and cost comparisons for various reactor types but also projects actual design of specific reactor systems.

Advantage to the utility's engineers will accrue from close frequent contacts with General Atomic's well-grounded nuclear engineers located in San Diego, Mr. Sherwin stressed. GA is building permanent laboratory facilities at Torrey Pines Mesa in northern San Diego, with the first building ready for occupancy in August. Its nuclear staff now totals more than 200.



THIS HYDROGEN BEAM device may help utilities find secrets of cheaper nuclear power. San Diego's Sherwin hears details from Gen. Dynamics' Dr. F. de Hoffmann

San Diego G&E's agreement is separate from that of the recently announced program of the Texas Atomic Energy Research Foundation with General Atomics. The latter study calls for a jointly sponsored, four-year basic research program on controlled fusion reactions.

NUCLEAR NOTES

EURATOM countries should buy or construct under license British, U. S., or perhaps Canadian reactors to start their atomic energy programs fast, a special commission recommends. The commission's plan would revise EURATOM's 6-million-kw goal for 1967 up to 15 million kw.

Lead gamma-ray shields will be used in 17 reactors to be constructed by Aerojet-General Nucleonics. Less bulky and lighter than the conventional water jacket, the lead shielding will simplify mass-production of the reactors. Water will be used for neutron shields.

Grants for foreign research totaling $2,450,000 have been approved by AEC as part of the Atoms-for-Peace program. AMF Atomics will build a 10-Mw reactor for Japan and a smaller one for Portugal. General Electric will fill orders for Spain and Venezuela. Other companies involved are Babcock & Wilcox in Brazil, Foster-Wheeler in Denmark, and American Car & Foundry in The Netherlands. The money was made available by the International Cooperation Administration from Mutual Security funds.

The USSR plans a 420 Mw plant with two water-moderated nuclear reactors, each to use 17 tons of uranium dioxide and 23 tons of enriched uranium. Each reactor will drive three turbogenerators, producing steam at about 525 F and 1,500 psi.

Japanese nuclear-powered ships may be built soon if the government approves Mitsubishi Electric Manufacturing Co's contract with International Westinghouse.

Southern California Ed Gets First Megawatt of A-Power

About one megawatt of nuclear power flowed into Southern California Edison Co lines July 12, marking initial delivery of energy from the Atomic International sodium reactor experiment in the Santa Susanna Mountains, the company reports.

Another milestone along the road to civilian nuclear power went by as the switch closed. It was the first time a non-military atomic energy reactor had produced power for electric generation by a private utility.

Initial test operations of SRE produced this power level, about 15% of rated electrical output. The plant is expected to achieve full power rating of about 20 Mw thermal and 6.5 Mw electrical later this year. Southern California Edison buys the surplus heat to drive a turbine-generator near the reactor.

Federal Power Feels "Sharp Edge"

Niagara legislation—speeded in the House by Congressman Buckley's quick session—stands best chance of passage; other bills face economy ax

The Administration's "no new starts" policy has had a sharp cutting edge for federal power projects.

Major projects such as the proposal for a high Hells Canyon dam and the Fryingpan-Arkansas stream diversion project look like certain casualties, while projects such as Trinity River—which passed without much opposition—are having difficulty getting funds.

Niagara Stands Best Chance

The project with the best chance of approval at this point is Niagara power development legislation, which requires no federal expenditure.

The $600-million project was approved by the House Public Works Committee in one session without benefit of hearings. Chairman Charles A. Buckley (D-N. Y.) was accused by some members of ramrodding it through. He defended his action by pointing out that lengthy hearings have been held in the past and the legislation has support of not only the New York Congressional delegation, but both senators and governor as well.

Prospects are that the House will act on the bill within the next two weeks, ahead of the Senate where the bill is blocked by civil rights debate. The Senate is expected to quickly enact Niagara legislation, once it disposes of civil rights.

Primary obstacle on Senate passage comes from Sen Joseph Clark (D-Pa.) who objects to proposed allocation of preference power to out-of-state public bodies. When legislation is brought up Clark is expected to make a strong attack on reservation of 20% of public preference power produced by the 2-million-kw project—which amounts to 10% of total power production. Clark wants more for municipal plants and rural electric co-ops in Pennsylvania and Ohio. He'll be backed by Sen Frank Lausche (D-Ohio) in his pitch for a bigger out-of-state allocation.

There are no public lines for carrying the power into Pennsylvania and Ohio. Power reaching those states from Niagara will have to be wheeled over private lines. Usual rate for wheeling such power is 1 mill per kwhr per 100 miles.

Clark and Lausche are sure to join Sen Richard Neuberger (D-Ore.) who already has said he'll oppose the 50% allocation to preference customers. Neuberger favors full preference. He feels it should be written into the law although 50% allocation will more than cover needs of all present and anticipated public customers.

Hells Canyon Appears Stopped

Two major reclamation bills already approved by the Senate—Hells Canyon Dam and Fryingpan-Arkansas stream diversion—don't appear to have much chance of getting out of the House Interior Committee.

An Interior subcommittee recently disapproved the Hells Canyon bill and that should have been the final word on it. Proponents appeared willing to let it remain in committee. But the White House was fearful that if the bill were not killed with finality of full committee disapproval, it somehow might get passed and put the President in the uncomfortable political position of having to veto. So Republicans on the Interior committee have launched a drive to get the bill before the full committee for a final vote.

BUCKLEY: A fast-acting man

"Kill" Votes Available

They have the votes to kill it. But by parliamentary maneuvers, Chairman Clair Engle (D-Cal.) has prevented a vote at the past two meetings. Engle, who plans to run for the Senate in California next year, is determined not to lose control of the committee to Republicans. And Republicans, with an assist from two Southern Democratic members, are equally determined to kill the Hells Canyon high dam.

Chances are the Republicans will be able to kill off H.R. 5, the bill disapproved by the irrigation subcommittee. But there are also the Senate-passed bill and several similar bills before the subcommittee. The real fight will be whether the Republicans can discharge the subcommittee of these bills or whether the Democrats can keep them bottled until a more favorable day.

Await Election Year

Most members who have projects are holding them back. Many feel that the current economy mood will pass and that there will be better sailing for public works projects as election day approaches next year.

A blow at public power is the bill before the House Interior Committee that would authorize the Secretary of the Interior to enter into a contract with the Pacific Gas & Electric Co to build and operate power facilities at the $230-million Trinity River Dam project. Chairman Engle, who takes the position that the government should build power facilities as well as dam, plans to hold hearings this session after Hells Canyon legislation is settled.

Jones Appointment Draws Democratic Fire

The Administration's appointment of a "non-controversial" Budget Bureau official to the board of the Tennessee Valley Authority is turning out to be a controversial one, indeed, to Valley Democrats in the U. S. Senate.

The nominee, Arnold R. Jones, former member of the Kansas Corporation Commission, was selected by Pres Eisenhower to succeed Raymond R. Paty, whose term expired last month. Jones would join Chairman Herbert D. Vogel to give the Administration a two-to-one board majority. Harry A. Curtis is the remaining Democratic-appointed member.

Called Non-Controversial

Jones' name went to the Senate for confirmation labelled by the White House as a "non-controversial" choice. Although neither of Kentucky's Senators—the only TVA area Republicans in the Senate—got the usual courtesy of first passing on the appointment, Jones appeared to face little opposition except from die-hard public power Democrats.

Sen John Sherman Cooper (R-Ky.) was disappointed that the President didn't name his choice, Republican Rep Howard H. Baker of Tennessee to the vacancy. But Cooper indicated his disappointment would not turn into opposition.

JONES: Faces into storm

Sen Thruston Morton (R-Ky.) endorsed the appointment after the President's choice, and after he'd talked with Jones.

But last week, opposition was growing beyond TVA boundaries. The Washington Post & Times Herald, a pro-TVA newspaper, was re-printing articles on Jones' background written by Nat Caldwell, of the "Nashville Tennessean." Democrats seized on the series to bolster their drive to stop confirmation of Jones.

Newspaper Blasts Jones

The stories quote Rural Electrification Administration co-operative spokesmen and Democrats in Kansas, including Gov George Docking, alleging that while Jones was on the Kansas Corporation Commission private utilities got preferential treatment over rural co-ops—and that the law firm of which Jones was a member received legal fees while Jones was on the commission. (Kansas law does not prohibit such activities.) Jones served from 1939 to 1942.

The Senate Public Works Committee, which handles TVA nominations, is not making any move to act on the appointment. Pro TVA Democrats are confident the committee will take no action.

Kefauver to Draw Bead on Power Ads

Sen Estes Kefauver (D-Tenn.) will turn his guns on private utilities advertising practices once he wrings the last bit of mileage out of the fast tax writeoff inquiry centering around Idaho Power Co.

He expects to get to the subject of advertising—specifically the 1956 campaign of Electric Companies Advertising Program (ECAP)—before Congress adjourns. That timetable would mean Kefauver wants the results of an inquiry now being made by the Internal Revenue Service to come in by next month. Internal Revenue Commissioner Russell C. Harrington has a field inquiry going on now to get the facts to base an opinion as to whether the ECAP advertising was a legitimate cost of doing business. Some 115 electric utility companies are reportedly being covered by IRS agents.

Kefauver questions the legality of utility companies charging off a series of institutional advertisements as a business expense. He charges that the ads were used as propaganda against public power proposals in connection with the Tennessee Valley Authority, the atomic energy program, and Hells Canyon Dam.

Kefauver appealed to the Internal Revenue Service.

Harrington says business deductions would not be allowed in cases where facts showed that advertising was for purposes of lobbying, for promoting defeat of legislation, or for political propaganda.

Kefauver claims that if the utility deductions are held to be unwarranted for tax purposes, then additional tax payments are due IRS. ECAP reportedly has spent in the neighborhood of $110 million on its advertising campaign. If this amount were taxable at the maximum corporate rate of 52% then contributing utilities would be liable for about $57 million taxes.

However, if Harrington rules that the deductions are legitimate, then Kefauver is sure to press for a Congressional probe.

Western Drought Relaxes Tight Grip

- USBR reports heavy snowpacks, spring storms bring "good" to "excellent" inflows to almost all reservoirs in the western states
- But Rio Grande reservoir shows no significant gain from past parched years, despite Texas flood-storms and moisture elsewhere
- And Hoover-Parker-Davis plants still are curtailed as result of drawdown over lengthy drought period. Outlook is good for year

WM. L. NEWMEYER, Chief, Div of Power Operations,

HERBERT S. RIESBOL, Chief, Hydrology Branch, U S. Bureau of Reclamation, Denver, Colorado

Water year 1957 (October 1956-September 1957) should be a good year for Bureau of Reclamation hydroelectric plants in the western United States. Heavy snowpacks accumulated during the winter of 1956-1957 in the Rocky Mountain area, and exceptional rain and snow storms occurred in the spring months of 1957 over the Great Plains and the Southwest. As a result, the severe drought conditions of recent years in most of the western states have alleviated. The table on opposite page, listing 31 plants built and operated by the Bureau of Reclamation, presents current characteristics and water outlook.

Seasonal precipitation in the Upper Colorado River Basin is running about 147% of the past 34-yr average. Present forecast is for good spring inflow to Lake Mead, possibly even approaching the 1952 annual inflow of 18 million acre-ft. Total average annual power generation at Hoover, Davis, and Parker Powerplants, on the Colorado River below the Utah-Arizona border, is about 7 billion kwhr. Curtailment of generation is still necessary, however, due to storage drawdown at Lake Mead during recent dry years.

Prospects for the water supply in the Central Valley of California have greatly improved because of a winter-type storm which occurred during the latter part of May. According to the Dept of Water Resources of the State of California, the forecast of April-July runoff in percent of normal as of June 1, 1957 now ranges from 57% on the Kern River in the southern end of the valley, to 104% on the Upper Sacramento River in the northern end. Although total generation still will remain below average, it will be good. Generation outlook is good at Shasta and Keswick Powerplants located on the Sacramento River and Folsom and Nimbus Powerplants on the American River.

The Pacific Northwest situation

varies from fair to excellent at this time. Many reservoirs are filled or nearly filled as of May 31, 1957. Storage in Franklin D. Roosevelt Reservoir, formed by Grand Coulee Dam on the Columbia River, is nearly normal. Average annual generation at the Grand Coulee Powerplant during recent years has been 14 billion kwhr.

Water runoff outlook in the Missouri River Basin states of Montana, Wyoming, and the Dakotas is considered good for the remainder of 1957. This will assist in improving storage conditions in the main reservoirs of the Missouri. Most of the mountain watersheds in this area have received normal or above-normal winter precipitation and much of the plains area has benefited from spring rainstorms. For example, Angostura Reservoir located on the Cheyenne River in southern South Dakota was filled as a result of a late-May rainstorm.

Rainfall Is 300% of Normal

The Colorado-Big Thompson Project, operated by the Bureau of Reclamation in northern Colorado for diversion of water from the Upper Colorado River on the western slope of the Rockies to the South Platte River on the eastern slope, received a decided boost in the water supply outlook during May when precipitation averaged 150-300% of normal in the high mountain areas. It is anticipated that generation during the summer months will be ample to meet power demands.

Water outlook for the North Platte Project in southeastern Wyoming is nearly normal as a result of heavy May precipitation. Prior to that time the outlook had been poor due to low holdover storage. With heavy spring precipitation, water release during the early summer for irrigation is not needed to the extent normally experienced and, as a result, more water will be held in storage.

The Rio Grande River Basin in New Mexico is probably the only important area in which the drought situation has not been improved significantly. On May 31, Elephant Butte Reservoir, located on the Rio Grande River in southern New Mexico, had only 7% of its active capacity filled, with prospects for below-normal water supply during the April-September period. Average annual generation at the Elephant Butte Powerplant is 68,971,000 kwhr and predicted generation for 1957 is less than one-third that.

Here's Water Outlook for Major Hydro Plants

Name of Plant	State	River	Rated Capacity MW	Average Annual Generation Mwhr	Active Reservoir Capacity (1,000 Acre-Ft)	Active Reservoir Capacity 5-31-57 (1,000 Acre-ft)	Current Water Outlook
Anderson Ranch	Idaho	Boise	27	154,896	423.2	438.5	Good
Boise Diversion	Idaho	Boise	1.5	4,363	*	*	Good
Black Canyon	Idaho	Payette	8	58,267	*	*	Good
Grand Coulee	Wash.	Columbia	1,974	14,009,558	5,072.0	4,762.0	Good
Hungry Horse	Mont.	Flathead	285	1,068,407	2,982.0	2,515.0	Good
Minidoka	Idaho	Snake	13.4	105,632	95.2	96.5	Excellent
Chandler	Wash.	Yakima	12	.....	*	*	Good
Folsom	Calif.	American	162	699,776†	920.3	897.5	Good *
Nimbus	Calif.	American	13.5	60,234†	8.8	8.0	Good
Shasta	Calif.	Sacramento	379	1,981,118	3,998.0	3,993.7	Good
Keswick	Calif.	Sacramento	75	424,554	20.0	19.3	Good
Hoover	Ariz-Nev.	Colorado	1,249.8	4,925,000	27,207.0	13,133.0	Good
Davis	Ariz.-Nev.	Colorado	225	1,225,233	1,809.8	1,751.1	Good
Parker	Calif-Ariz	Colorado	120	683,621	216.5	174.7	Good
Siphon Drop	Ariz	Canal, Colorado	1.6	15,209	.....	.....	Good
Elephant Butte	N. Mex.	Rio Grande	24.3	68,971	2,185.4	160.5	Poor
Pilot Butte	Wyo.	Canal, Wind River	1.6	13,991	*	*	Excellent
Shoshone	Wyo.	Shoshone	5.6	43,881	380.3	223.9	Excellent
Heart Mt.	Wyo.	Shoshone	5	49,999	*	*	Excellent
Angostura	S. Dak.	Cheyenne	1.2	4,330	92.0	90.2	Excellent
Boysen	Wyo.	Big Horn	15	73,278	710.0	279.2	Excellent
Canyon Ferry	Mont.	Missouri	50	320,566	1,615.0	1,442.9	Excellent
Estes	Colo.	Diversion	45	111,216	*	*	Excellent
Flatiron	Colo.	Diversion	71.5	256,002	*	*	Excellent
Green Mt.	Colo.	Blue	21.6	68,463	146.9	23.7	Excellent
Mary's Lake	Colo.	Diversion	8.1	41,942	*	*	Excellent
Pole Hill	Colo.	Diversion	33.25	201,034	*	*	Excellent
Alcova	Wyo.	No. Platte	36	104,731†	30.3	27.4	Good
Seminoe	Wyo.	No. Platte	32.4	117,652	1,012.0	351.4	Good
Kortes	Wyo.	No. Platte	36	130,204	4.7	4.7	Good
Guernsey	Wyo.	No. Platte	4.8	25,194	39.8	38.7	Good

* Water for generation obtained from higher elevation reservoirs on project.

† Began operation 1956.

Heat, Failures Hit PSE&G

A series of generation shutdowns and breakdowns hit Public Service Electric & Gas Co last week at the height of a heat storm which crested at 101F at Newark. The combination forced widespread load curtailment. The utility took to the radio and newspapers to plead for public cooperation in reducing loads while power salesmen asked larger customers to cut power use in every way possible. System voltage was reduced by an average of 4% as an emergency measure. At the end of the second day the utility was still urging conservation.

Spokesman for the company said that the public appeals brought fine cooperation but was not able immediately to appraise voluntary curtailment.

Two units totaling 265-Mw were down for routine maintenance when load started building Monday morning. Then trouble struck at the Linden plant where a 150-Mw unit got turbine trouble. Subsequently a boiler tube blew at the Kearney station, knocking out another 150-Mw unit.

Generation losses thus reached 565 Mw—or about one-fourth of Public Service's total capacity. Interconnections with Pennsylvania and upper New York were not able to supply the deficit.

"We're 99.96% Dependable"

Central Hudson Gas & Electric Corp has proclaimed its service 99.96% "dependable" in 1956—or 99.99% dependable if the year's major storms are ignored. A recent Operating Department report arrives at those percentages by interpreting service continuity in terms of "customer hours."

A breakdown of the non-storm interruptions shows as causes: Company equipment failure, 35.4%; lightning, 16.1%; external, 11.4%; trees, 11.2%; prearranged, 10.6%; overload, 5.7%; unknown, 4.8%; human error, 4.4%.

An Austere Argentina

Argentina is doomed to "austerity reaching the point of poverty" unless it can create a hospitable climate for foreign investments in utilities, predicts Minister of Commerce and Industry Dr Julio C. Cueto Rua. Meat and food-product profits are being spent abroad, he pointed out, for electrical generating equipment and fuel.

The country's minimum electrical needs now exceed present supply by 750 Mw, Dr Rua said. Total installed capacity is 2,150 Mw, but only 1,600 Mw can be considered operative. Of 785 Mw owned by State Water & Power Board, 375 Mw still lack transmission and distribution lines in most cases. And 180 Mw is in equipment either broken down or so antiquated that it should be replaced immediately. Another 250 Mw must be replaced before long.

Electricity is available only to 62% of Argentina's population—the same percentage as six years ago, and only 5% more than ten years ago, he said.

Thirty Years of Safety

Carolina Power & Light Co observes that its meter section "appears to have set some sort of a national record." In 30 years—representing 1,488,000 man-hours worked and 3.4 million miles driven—the section has not had a single lost-time accident. Its 44 employees test and maintain 400,000 meters.

Ready and Set to Go

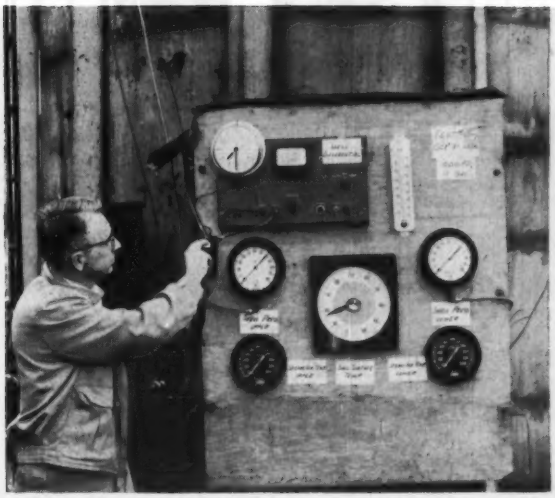
New York State's Power Authority is preparing itself for the moment when it gets an official go-ahead on the Niagara Power Project. It called for bids on thirteen 200,000-hp hydraulic turbines for the Lewiston Power Plant. Baldwin Lima Hamilton and Newport News Drydock and Ship Building Co were low bidders at $20,415,600. The Authority awarded them a letter of intent contingent on Congress permitting construction. Second low bidders were Allis-Chalmers Mfg Co and S. Morgan Smith Co at $20,666,200.

LAW&P Eyes Arizona Site

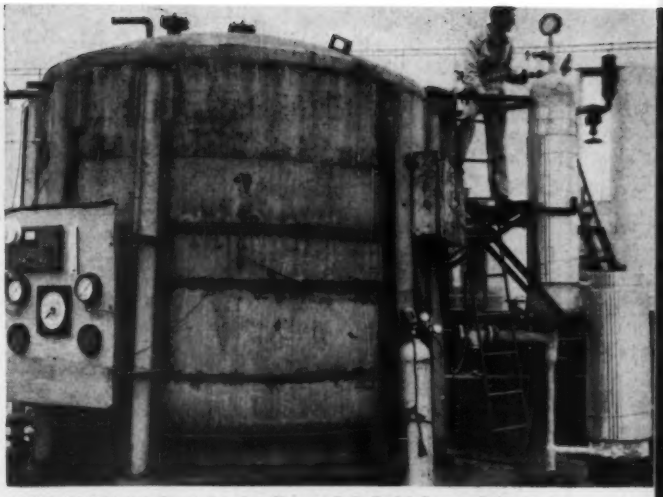
Los Angeles Dept of Water & Power has applied to Federal Power Commission for a preliminary permit to construct a $400-million dam and power plant in Arizona on the Colorado River at Bridge Canyon. The 673-ft-high dam would be 117 miles upstream from Hoover Dam, and would have a 750-Mw capacity. It would produce almost twice the amount of power now allotted to Los Angeles by Hoover Dam. Transmission lines, 400 miles long, would cost another $109 million.

Cost of power delivered in Los Angeles would be slightly less than the present cost of steam-generated power, the Department estimates. But this power cost would remain independent of fuel-oil price changes. Steam plants now supply more than 75% of W&P's power.

W&P's proposal, however, has produced howling indignation in Arizona. The state is seeking Congressional approval of a Bridge Canyon Dam, which it describes as the "key point" of its proposed Central Arizona Power Project. Part of this plan calls for a pump-lift operation to raise Colorado River water to a canal which in turn would deliver it to Salt River Valley farms by gravity flow. The Central Arizona Power Project has succeeded twice in the Senate but has failed both times in the House.



INSTRUMENTS FOR containment vessel tests were mounted on a board beside test tank. Seventeen tests were performed



STEEL TANK 10 ft, 6 in. in dia and 8 ft high used in test simulated a reactor containment vessel for test purposes

Containment Vessel Can Be Reduced

GENERATION
Design

Tests show metal plates or water in shell prevents pressure rise from incidents and cuts size and strength needs

ALF KOLFLAT, Senior Partner, and
W. A. CHITTENDEN, Atomic Power Engineering Group, Sargent & Lundy, Engineers, Chicago, Ill.

Application of heat-absorbing material, either metal plates or water, eliminates pressure rise in reactor vessels following a nuclear incident. Tests conducted by Sargent & Lundy for contemplated reactor installation for a Belgian firm lead to this tentative conclusion. In view of the cost of containment shells, such application of heat-absorbing material within the shell appears to offer real economies by reducing the size and strength of containment vessels.

The concern of Belgian engineers with stresses in the containment

Table I—Summary of Test Series

Test Conditions	Bare Steel Shell										Concrete-lined Shell			
	Horizontal division plate and trough in place. Trough empty except for Test No. 9. Note 1										Plate and trough removed			Note 2
Test No.	3	4	5	6	7	8	9	11	12	13	14	15	16	17
Outside Air Temp., F	70	66	69	65	....	70	72	65	60	55	39	22	30	34
Initial Shell Temp., F	84	66	95	78	54	82	84	66	70	64	40	22	30	36
Boiler Pressure, Psig	400	600	1,000	400	600	1,000	600	400	845	1,000	1,000	1,000	1,000	1,000
Water in Boiler, Lb	125	102	92	240	200	158	200	291	291	266	266	266	266	266
Max. Shell Press., Psig	8.5	8.0	8.0	11.0	11.0	12.0	10.0	14.0	20.0	21.0	24.0	37.0	38.0	0.0
Max. Vapor Temp., F														
Lower Shell	205	198	204	217	210	219	215	225	242	242	222	243	250	56
Upper Shell	120	103	118	138	124	143	124	160	185	189	219	242	250	56

Notes: 1. Manhole in division plate open in Tests 11, 12, and 13. 2. Special water trough installed in Test 17.

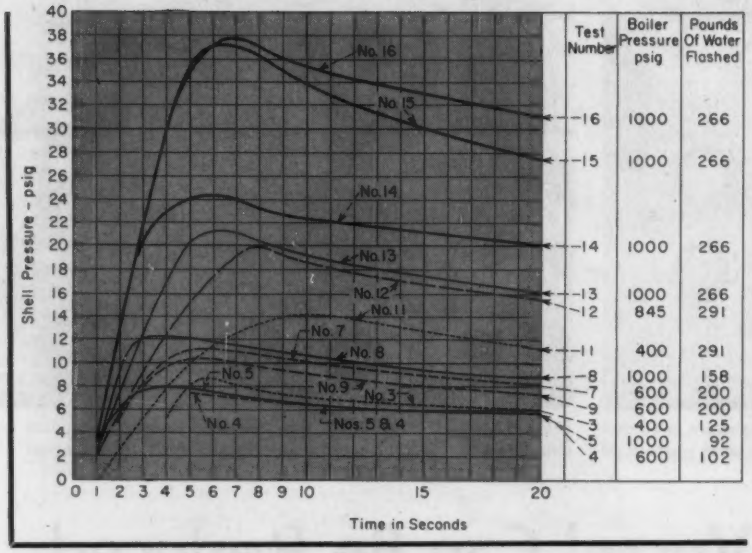


FIG 1—MAXIMUM SHELL PRESSURE occurred within 7 sec or sooner. Pressure peak occurred later for lower boiler pressure and slower water discharge to tank

shell's plates due to the sudden release of steam in event of an accident prompted the tests.

The tests were carried out with a steel tank 10 ft 6 in. in dia and 8 ft high. The tank simulated a containment vessel. It had a total volume of 792 cu ft and a surface of approximately 470 sq ft. Walls were of $\frac{3}{16}$-in. steel plate. The tank was satisfactory for a maximum pressure of 45 psig.

The test arrangement is shown in the accompanying photographs. A nuclear reactor, or boiler, was simulated by a pressure vessel which was made from a 14-in. pipe section 6 ft 7 in. long. Water could be brought up to 1,000 psig in this pipe section by means of a propane burner arranged under a connected pipe coil. This boiler arrangement was located outside the containment vessel.

Contents of the boiler were released into the containment vessel through a 2-in., quick-opening valve discharging into a 6-in. distribution pipe. To prevent leakage during the heating period, a 2-in. gate valve was installed ahead of the quick-opening valve. The quick-opening valve was air operated and its full travel was completed in 1.5 sec. The 6-in. steam distribution pipe extended across the interior of the vessel, 2 ft above the floor. The distribution pipe was capped at the end and had two rows of 19, 1-in. dia holes drilled 45 deg from the center line. They were positioned so as to direct the steam and water down.

Different internal arrangements were used in the tank for different tests. A horizontal division plate $\frac{3}{16}$ in. thick was installed in the center of the tank. This divided the tank into two separate compartments. A 4-in. slot allowed steam to pass from the lower to the upper section of the vessel.

Water Trough Added

A water trough was installed under the slot during some tests. The trough was filled with water so that it might be seen whether steam passing from the lower to the upper chamber over the water would materially affect the condition. A manhole in this division plate facilitated access This aperture, which was 254 sq. in., was open during some tests.

In one test series the division plate and all internal equipment, except the steam distribution pipe, were removed so that the entire vessel had no internal restrictions.

After the tests had indicated a considerable heat absorption in the steel plate, an alternate arrangement was made in which the tank was covered with a 1½-in. concrete lining to simulate the walls frequently provided in actual nuclear installations. For one test, a water trough was installed directly beneath the distribution pipe with side plates to insure a thorough mixture of the flashed steam and water in the trough.

The tests, conducted in the open, were subject to weather conditions. Weather, however, had little effect on the tests. Radiation loss from

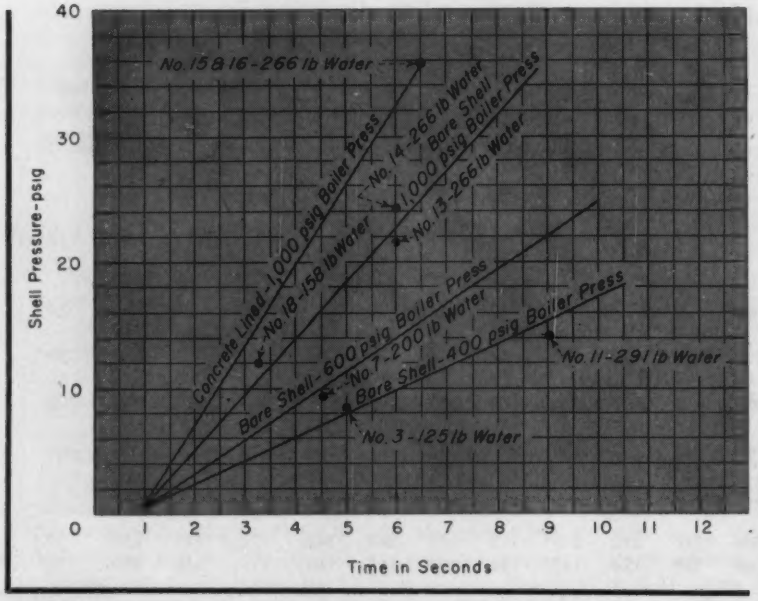

Shell Pressure - psig
Time in Seconds
No. 15 & 16 - 266 lb Water
No. 14 - 266 lb Water, Bare Shell, 1,000 psig Boiler Press
No. 13 - 266 lb Water
Concrete Lined - 1,000 psig Boiler Press
No. 18 - 158 lb Water
Bare Shell - 600 psig Boiler Press
No. 7 - 200 lb Water
Bare Shell - 400 psig Boiler Press
No. 11 - 291 lb Water
No. 3 - 125 lb Water

FIG 2—SHELL PRESSURE rose with an increase in initial boiler pressure. Maximum shell pressure rise time was proportional to amount of water discharged

the tank was very small during the critical period.

Seventeen tests were conducted. Thirteen were with the bare steel tank and the horizontal division plate and trough in place. One, No. 14, was with the bare steel shell, the horizontal division plate and trough having been removed. In three tests the concrete-lined shell and the horizontal division plate and trough were removed. Test results are shown in Table I.

Additional Opening Used

The horizontal division plate, which was in place for tests 1 to 13 had a 4-inch wide opening across the entire plate, giving approximately a 3-sq ft opening. In tests 12 and 13 there was an additional opening 18 in. in dia in the plate.

Vapor pressures in the shell during the first 20 sec, the most important period of the problem, are shown in Fig. 1.

As indicated in the curves, maximum shell pressure usually occurred within 7 sec or less. Where maximum pressure occurred as late as 8 to 10 sec from the start of the test, boiler pressure was lower and discharge of hot water from the boiler to the tank slower.

Maximum pressure obtained in relation to time and original boiler pressure is shown in Fig 2. For the same initial boiler pressure the maximum shell pressure rise time was proportional to the amount of water discharged.

Vapor temperatures, measured in the upper and lower sections of the tank, are shown in Fig 3. On the curves, U denotes readings in the upper and L the readings in the lower sections. For tests 14, 15 and 16, when there was no partition in the tank, upper and lower readings were averaged. Vapor temperature lagged vapor pressure slightly.

Shell Absorbs Heat

Calculated shell vapor pressure and total heat of all the vapor in the test shell are shown as almost a straight line, Fig 4. The lower line, with test numbers shown, indicates pressures experienced. The difference is accounted for by heat absorption by the shell. Partial vapor pressures are measured from the zero line.

Actual plotting of test points is illustrated by the point shown for

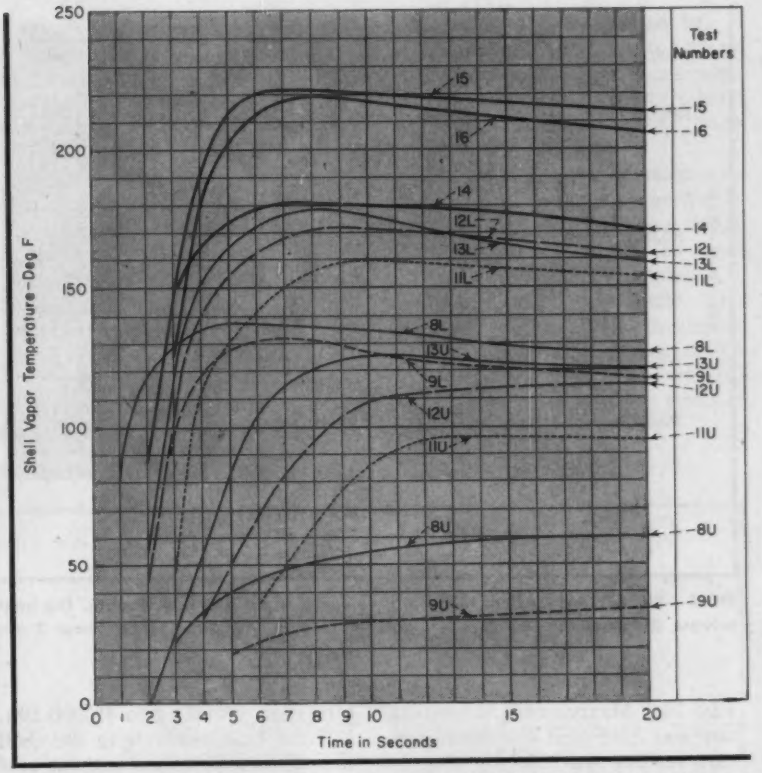


FIG 3—VAPOR TEMPERATURE in upper shell section lagged that in lower section slightly. For tests 14, 15, and 16, the two temperatures were averaged

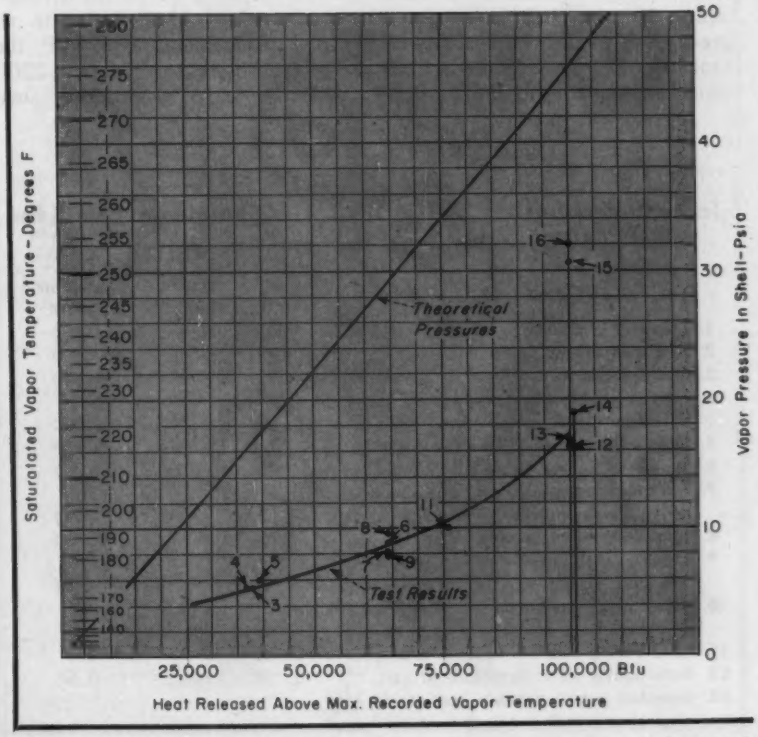


FIG 4—THEORETICAL AND ACTUAL maximum vapor pressures varied appreciably. Shell pressures actually experienced are indicated by the numbered dots

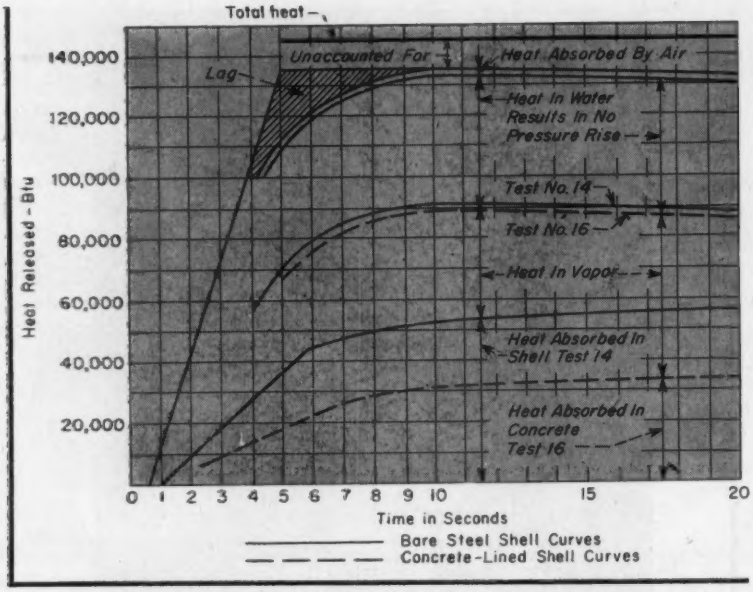


FIG 5—PRACTICALLY ALL of the heat is released in the first few seconds. The heat release diagram for Test Nos. 14 and 16 indicate this time to be about 5 sec

Test 14. Maximum shell temperature was 220F and maximum pressure reading was 24 psig (Fig 1). Total heat in the 266 lb of water released at 1,000 psig in the boiler is 146,000 Btu. After the pressurized water was injected into the shell and at the time when the maximum pressure existed in the shell, the heat remaining in the water at 220F which was not contributing to vapor formation amounted to 45,000 Btu.

Total heat available in the shell for pressure formation without heat absorption in the shell or internal surfaces approximated 101,000 Btu, (146,000-45,000) which determined the test point on the horizontal scale. At 220F and with an initial air temperature of 40F, the partial absolute air pressure at 220F is 19.8 psia. The observed shell pressure was 38.7 psia. Deducting from this the partial air pressure of 19.8 psia gives an absolute vapor pressure of 18.9 psia and Test 14 was plotted accordingly in Fig 4.

The theoretically expected vapor pressure read from the straight line curve is 46.0 psia so that actual vapor pressure is 41% of that expected without heat absorption. Other test points were plotted similarly.

A lower vapor pressure was obtained in all tests where a division plate was used, in contrast with tests without a division plate. This is due partly to the heat-absorbing capacity of the division plate and partly to the higher heat transfer rate in the lower compartment for the two-compartment tests.

In Test 14 the expected theoretical vapor temperature was 275F. Actual temperature was 220F.

Where the heat went in the first 20 sec after release of water from the boiler into the shell is shown in Fig 5. Test 14 was with a bare steel shell and Test 16 with the concrete-lined shell.

Heat Released in 5 Sec

Total heat released, based on initial water temperatures above 32F, was 146,000 Btu, so there is an 8% item unaccounted for. Practically all the heat was released in 5 sec. The cross-hatched area represents the lag in temperature and pressure readings.

Heat absorbed by the tank in Test 14 (with the bare steel shell) was based on the temperature rise which occurred in the ⅜-in. shell section and on the total weight of the tank. In the first 10 sec the shell absorbed 51,000 Btu and in the next 10 sec, the shell absorbed only 6,000 Btu more.

In Test 16 (with the concrete-lined shell) heat absorbed in the concrete was determined by subtracting the heat remaining in the water and the vapor, the heat absorption by the concrete being the difference. Heat absorbed by the steel shell in the first 10 sec was 52,000 Btu. Heat absorbed by the concrete lining was 31,000 Btu, or 60% of that absorbed by the steel shell. At the end of 20 sec the figure was 56,000 Btu for the steel shell and 34,000 Btu for the concrete lining.

The tests were made with a shell

Table II—Comparison of Test Shell with Containment Shell for EBWR at Argonne National Laboratory

	Test Shell		Shell for EBWR
1. Diameter of shell, ft	10½		80
2. Free shell volume, cu ft	792		400,000
3. Shell surface, sq ft	470		34,000
4. Total heat absorbing surface in shell and equipment (steel equivalent), sq ft	470		70,000
5. Ratio surface to volume, sqft/cuft	0.6		0.175
6. Weight of boiling water, lb	266	(Test 14)	20,000
7. Extra heat released in case of chemical reaction expressed as boiling water equivalent, lb	....		20,000
8. Total boiler water equivalent, lb	266		40,000
9. Expected shell pressure without heat absorption, psig	50		15
10. Actual maximum pressure in shell (Test No. 14), psig	24		....
11. Ratio boiling water to volume, lb/cuft	0.335		0.1
12. Ratio boiling water to surface, lb/sqft	0. 56		0.57
13. Expected actual pressure considering heat absorption in shell and equipment, etc (based on comparison of test results), psig	....		5-7

having a ratio of surface to volume of 0.6. The hot water released in Test 14 was 266 lb. Ratio of water released to shell volume was 266/792 or 0.335 lb per cu ft.

The shell, designed for Argonne National Laboratory's experimental boiling water reactor, has an outside surface of approximately 34,000 sq ft and a net volume of 400,000 cu ft. Because this is an experimental reactor, allowance was made for the possibility of additional chemical energy, the equivalent to 20,000 lb of pressurized water being released. Under normal conditions this water is at 600-psi pressure but it may go to 700 or 800 psi under certain conditions.

A comparison of the test shell with the Argonne EBWR shell is given in Table II. The pressure obtainable in the Argonne shell cannot be calculated exactly, with proper allowance for absorption, because the volume-to-surface ratio is so different from that of the test shell. In the test shell, pressure was reduced from 50 to 25 psig by shell absorption. From a comparison of the data, it was concluded that actual shell pressure in the Argonne installation would not exceed 5 to 7 psi, when consideration is given to heat absorption, as compared to 15 psig without heat absorption.

Installed Inside the Shell

When the tests were started, it was apparent that a very substantial reduction in shell pressure was due to heat absorption by the shell. The tests indicate that such heat absorption media can be installed inside the shell much cheaper than as a part of the structure.

To show that it is possible to eliminate completely pressure increase in the shell, Test No. 17 was conducted. A water bath of approximately 690 lb was installed under the distribution tube where the steam was discharged to the shell. The concrete-lined shell had no partition wall. The tray had been arranged in such a manner that as the steam discharged from the boiler it created a spray effect in the water.

Apparently this was effective enough to eliminate any pressure rise in the shell, even though 266 lb of water were released from 1,000 psig under conditions similar to those in Test 14. This has lead to the conclusion that application of heat-absorbing material, either metal plates or water correctly arranged, may eliminate all pressure rise in the shell.

A tentative arrangement for such an installation for the EBWR at Argonne is shown in Fig 6. Two schemes are shown, one at the left with open trays and one at the right with closed water containers. The containers are of very light sheet material so that they would break readily to release sufficient water to avoid pressure increase in the shell in event of an incident.

The Argonne installation has a 15,000-gal tank connected to a spray system, but the system is intended for rapid reduction in pressure after the maximum pressure has been reached.

In order to prevent or materially reduce the increase in pressure in the containment vessel, the water must be arranged so that the cooling action begins immediately, at the moment of the incident. The tests showed that the maximum pressure occurred within 6 to 10 sec after the boiling water was released from the test boiler into the test shell.

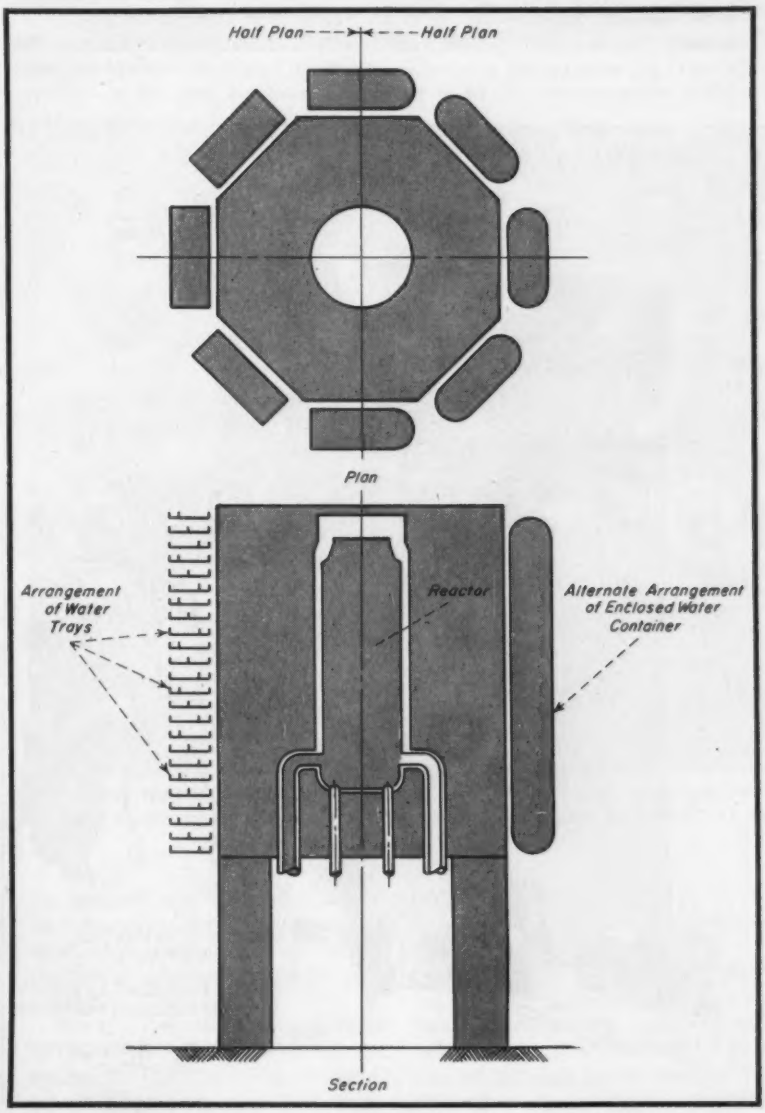


FIG 6—PRESSURE RISE, in case of an incident, may be prevented by proper location of water around the reactor to absorb heat released by the incident

12.47 Kv Proves Success in Southern

- Narragansett Electric Co adapts distribution voltage in 15-kv class to short distances and densely populated area
- Company has converted over 200 circuit miles to 12.47 kv; very few sources of trouble in three years of operation

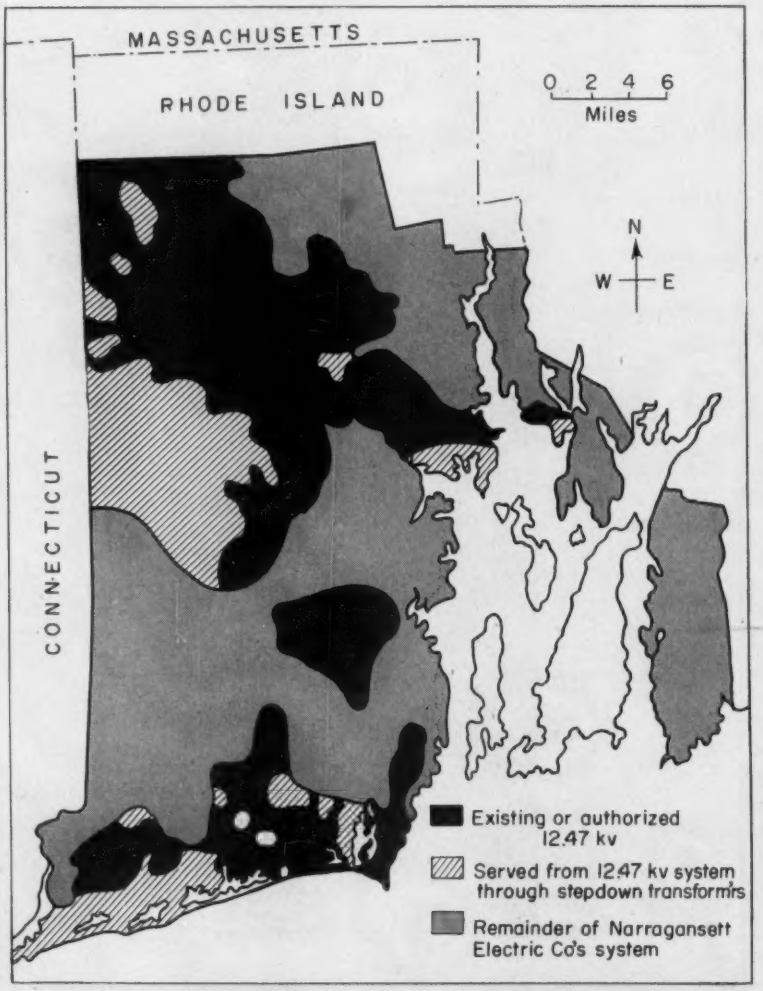
PAUL S. SHELTON, Engineer, Narragansett Electric Co, Providence, R. I.

Narragansett Electric Co has proved that distribution voltage in the 15-kv class is adaptable to areas with relatively short distances and densely concentrated people and trees. Previously, distribution at this voltage level has been most often used in large, thinly populated areas. Indeed, some previous opinion has held that New England was definitely not the place for distribution above 5 kv.

But Narragansett Electric has converted over 200 circuit miles to 12.47 kv to date. A substantial additional amount of 4.16-kv circuit is supplied from the 12.47-kv system through step-down transformers. And a major portion of the 1957 distribution construction schedule is devoted to extending the conversion to 12.47 kv.

Three years of operation have disclosed very few sources of trouble peculiar to the 12.47-kv system. Occasional transformer bushing flashovers have been caused by over-inquisitive squirrels, but a neoprene terminal cap solved this problem.

One major hurricane and several less severe ones have exacted their toll of the entire system. In general, however, the 12.47-kv system has suffered less damage and has been more readily restored to service than the contiguous 4.16-kv system. Several times the more common vagaries of weather, such as lightning and sleet, caused numerous interruptions to parts of the 4.16-kv system without affecting the 12.47-kv.



SYSTEM MAP of Narragansett Electric illustrates the extent of the area which is scheduled to be served by 12.47-kv circuits by the end of this year

High Degree of Reliability

It is recognized, of course, that such reliability is largely a result of extensive rehabilitation during conversion and of increased phase spacing and clearances. However, this high degree of reliability does indicate that 15-kv class distribution, properly designed and maintained, can be a valuable tool in the effort to keep distribution capacity ahead of the load.

Load growth of about 7% a year has been rapidly using up the capacity of the company's 4.16-kv wye system. Expansion of distribution capacity at 4.16 kv is increasingly hampered by rising costs of substations and rights-of-way for supply circuits, difficulty in obtaining sites for substations, and the increasing cost and resulting congestion of heavy distribution feeders. All of these difficulties are eased by use of higher voltage.

Consequently, the company initiated studies four years ago to determine the relative economics of increasing the distribution voltage as against further expansion of the 4.16-kv system. As a result of

New England

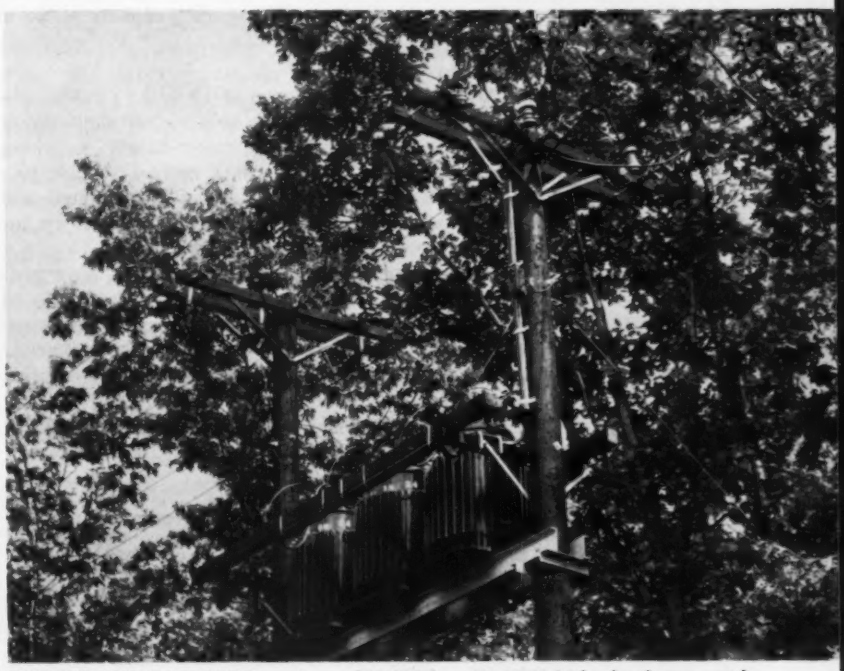
these studies, Narragansett divided its service area into three categories:

1. 4.16-kv area—That area which appears logical for further development at 4.16 kv because of load density, proximity to substations, previous commitment in underground or aerial cable, or other reasons.

2. 12.47-kv area—That area which appears suitable for ultimate development at 12.47-kv. This area includes a number of existing 4.16-kv substations which will continue to serve load within their present capacity limitations for many years. Expansion of these areas will be in the direction of 12.47 kv, with the 4.16-kv portions gradually cut back in size as load density increases. Construction in these areas will be based on requirements of future 12.47-kv distribution as to pole heights, clearances, and so forth. Due consideration will be given, of course, to the probable timing of conversion.

3. 8.32-kv area—A geographically isolated and limited portion of the system, now operating at 4.8-kv delta, will be developed at 8.32-kv wye. Although this voltage was not adopted for the rest of the system, conversion of this existing isolated delta system to wye appears to be the logical initial step.

NEW ENGLAND'S tree-lined streets have been a deterrent to 12.47-kv distribution in the past but have not proved to be an insurmountable problem



STEPDOWN TRANSFORMERS such as this 500-kva 12.47/4.16-kv bank are used to defer conversion of 4.16-kv branches where main supply is from 12.47 kv

Trend to 7.2/12.47 Kv

As a prerequisite of cost studies, it was necessary to establish some general specifications for the type of higher-voltage distribution system to be considered. Transformer sales figures showed a heavy national trend toward 7.2/12.47 kv. This indicated that 12.47 kv was the voltage in the 15-kv class at which future equipment costs would be most likely to benefit from mass production.

As this voltage is also compatible with the company's existing 11.5-kv distribution supply system, through use of transformer taps, a 7.2/12.47-kv multi-grounded wye system was chosen for consideration.

Conversion to 4.8/8.32-kv distribution was also considered in the early stages of the study. This voltage was selected, however, only for the isolated area mentioned above. In that area the existing commitment in 4.8-kv transformers minimized the new investment needed for conversion to 8.32 kv.

For study purposes it was feasible to select certain portions of the system for consideration by themselves. Substation areas were classified on the basis of load density as (1) rural—under 100 kva per sq mile, (2) suburban—100 to 1,000 kva per sq mile, and (3) urban—over 1,000 kva per sq mile.

Load growth rates were estimated for these three density classifications based on historical and predicted information. The study was then carried through to an overall undiversified system peak of three times the 1953 load.

Because 12.47-kv distribution

SPREADER-TYPE cable offers a solution to prob'em of multiple circuits in trees. Note 4.16-kv aerial cable below

NEOPRENE TERMINAL CAP for use on all transformer makes appears to be answer to inquisitive squirrels and birds

offered maximum attractiveness in low-density areas, portions of the rural area were studied first. Results of this study indicated a cost saving of over 20% in favor of the 12.47-kv plan for the area studied. This saving was largely the result of eliminating two proposed 4.16-kv subs and associated supply and feeder circuits.

The advantage of 12.47 kv over 4.16 kv is somewhat less clear-cut in suburban areas. This advantage would depend on such factors as availability of existing 11.5-kv supply circuits suitable for conversion to distribution circuits and on the ability of 12.47-kv distribution to eliminate or defer the need for additional 4.16-kv substations and feeders. Another factor is the abnormally rapid growth rate—25 to 30% a year in some suburban areas—which creates a situation favorable to the higher-capacity 12.47-kv system.

Generally, in both rural and suburban areas where 12.47-kv distribution has proved out, maximum use is made of existing 4.16-kv facilities. Where it is possible to defer conversion of branches, they are served from 12.47-kv feeders through step-down transformers. Existing 4.16-kv subs in 12.47-kv areas are retained in service, and, as load density increases, their service areas are gradually cut back and transferred to 12.47-kv circuits. By thus being able to add capacity in increments more nearly matching load growth, a more favorable picture is created of both annual and cumulative carrying charges on investment.

Urban areas, however, have generally not yet proved favorable to 12.47 kv. Heavy existing commitments in 4.16-kv subs and aerial and underground cable, coupled with a lower rate of load growth, have indicated the desirability of expanding 4.16-kv capacity in urban areas.

Boosting Feeder Ratings

Short distances in urban areas frequently make it possible to change these feeders from 250 to 333 or 500-amp rating at relatively small expense. It is anticipated that some urban areas, where existing 11.5-kv supply circuits are available, may prove favorable to 12.47 kv. But such has not been the case in areas studied to date.

The 12.47-kv system was designed on the basis of a nominal feeder rating of 4,500 to 5,000 kva, or about three times the present 4.16-kv feeder rating. It is felt that fault exposure of any given group of customers on an adequately sectionalized feeder of this size, supplied from a major substation, is not significantly greater than where supplied from a 4.16-kv local sub with the combined fault exposure of the 4.16-kv feeder, substation equipment, and supply circuit.

The main feeder backbone is equipped at suitable intervals with sectionalizing switches. It will, as the system develops, also be tied to adjacent feeders. In general, all branches off the main feeder will be protected by automatic reclosers or sectionalizers and repeating or single-shot fuse cutouts, depending on the relative load, importance, exposure, and interrupting duty of the branch.

Feeder breaker relaying includes a ground relay as well as overload relays. It is arranged for instantaneous initial trip and reclosure and three subsequent time delay trips before lockout.

For short-span, straight-line construction, 35-ft poles are basic. This design is based on use of a 32-in. pole-top pin for a single-phase wire or the middle phase of a 3-phase circuit. Additional phases are mounted on the ends of an 8-ft, 6-pin crossarm. Common neutral and secondary conductors are generally mounted on 3-spool racks with the top spool 21 in. below the crossarm gain.

Modifications of this pole-top arrangement, such as junctions, deadends, and angles, will generally require taller poles. These modifica-

tions depend, however, on the ability to work out clearance requirements on the portion of the pole available under joint-ownership agreements.

The 12.47-kv construction uses one-piece, brown-glaze radio-interference-proof insulators rated 10 kv. They are mounted on standard 1-in. steel drive pins and are supplemented by the impulse insulation of a minimum of 12 in. of wood from phase-to-phase and phase-to-ground. Deadends have two 6-in. disc insulators.

Distribution transformers for single-phase and wye-connected 3-phase installations are of the self-protected type. They have an integral secondary breaker, primary fuse, and lightning arrester, with one primary bushing and a grounded tank. Delta-connected 3-phase installations, on the other hand, use conventional two-bushing transformers.

Step-down transformers rated 7.2/2.4 kv, which are sometimes used to defer conversion of branches, are mounted on pole platforms or individual poles, depending on their size. Most frequently used are 50, 100, and 167 kva. These are conventional single-phase transformers connected wye-wye with fuse protection on the normal supply side.

Early consideration of 12.47-kv contemplated elimination of series street lighting in 12.47-kv areas. The high cost of conversion to multiple, however, has prompted reexamination of this project. It has been found feasible to retain one or two series wires on a line carrying one or two 12.47-kv phases. Addition of series to 3-phase lines will generally require 8-pin crossarms or taller poles. Using the feeder neutral as a series return has produced a compromise system based on minimizing the use of series on 3-phase lines but retaining it in some single-phase areas.

Tree-trimming costs for 12.47 kv average about 20% higher than for 4.16 kv, principally as a result of additional clearing required by wider phase spacing. Once clearances are established, however, it is expected that maintenance trimming will be about the same.

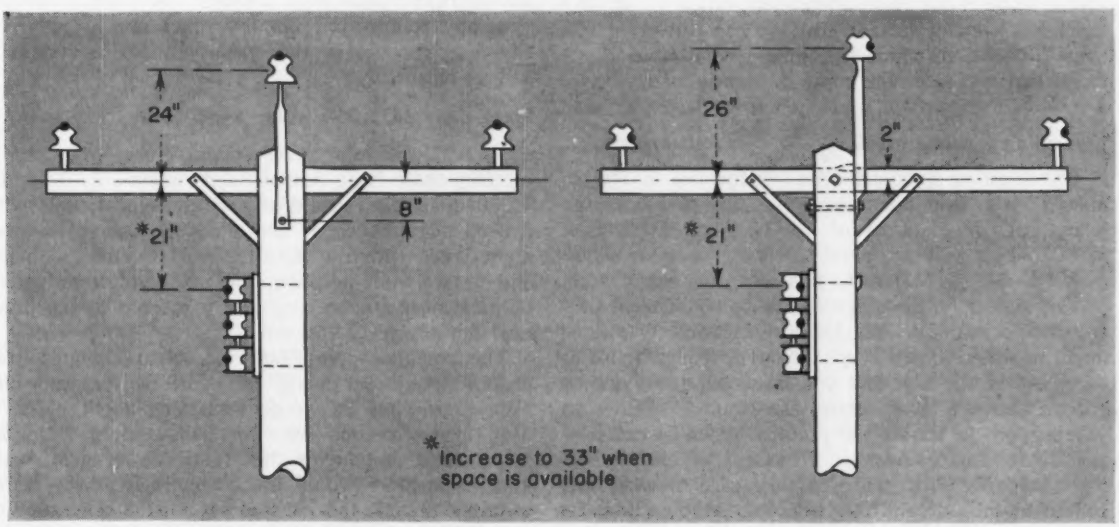
Solving the Tree Problem

An interesting sidelight to the tree problem is reflected in the experience of an affiliated company in Massachusetts. This company, in embarking on a program of conversion to 15-kv class distribution, was faced with severe tree problems where trimming had been extremely difficult to obtain. The company initiated its approach through interested state agencies and enlisted the support of local garden clubs and tree wardens in a program of shade-tree rehabilitation.

This program has greatly eased the problem of adequate tree clearance. Removal of diseased and dying trees, along with replacement in some cases with species more compatible with overhead lines, has resulted in a public acceptance that has greatly exceeded expectations.

Narragansett has made no attempt to utilize fully insulated tree wire of the type suitable for exposure to continuous abrasion and contact. Extensive field tests have demonstrated the ability of ordinary polyethylene-covered line wire to withstand intermittent brush contacts over an extensive period without breakdown. While use of such wire is certainly not intended to take the place of adequate trimming, it appears to offer possibilities in areas where danger of branches blowing into wires cannot be avoided.

Narragansett is experimenting with an installation of about ½ mile of spreader-type aerial construction, consisting of three insulated conductors suspended from a messenger by means of plastic spacers. It has been installed on the same poles as an existing 4.16-kv aerial cable feeder in an area where their routes coincided. Although field experience at this voltage is limited to a few months, it seems to be a feasible answer to pole congestion in the few areas where multiple circuits are unavoidable and where adequate tree clearances for open-wire construction cannot be obtained.



EXCERPT FROM STANDARDS shows Narragansett Electric's basic pole-top configuration, using 35-ft pole, for the company's 3-phase 12.47-kv distribution. Straight-line pole design is at left, and the angle pole is shown at right

What's the Future of Solar Energy?

- Author advises that we attempt to break through solar barrier with investigations of solar energy and related areas such as transmission
- He sees no fundamental reason why solar plant could not serve load 1,000 miles away; ties to other power sources could carry night loads

THEODORE BAUMEISTER, Stevens Professor of Mechanical Engineering, Columbia University; and Consulting Engineer, General Public Utilities Corp, New York, N. Y.

Have you, as a power engineer, ever tried to evaluate the potential of solar energy? Have you ever asked yourself: "When are we going to do something about solar energy?"

Let's look at the attractions of this solar energy. This look could seem foolhardy in the light of history and the many inept attempts to harness the sun. Despite this unfortunate circumstance, there are certain fundamental facts which the power engineer should bear in mind.

These facts, translated into numbers, might look like this:

The energy reaching the earth's outer atmospheric envelope from the sun is 7 Btu per min per sq ft, or 400 Btu per hr per sq ft, approximately.

If that energy could be harnessed by a power plant with a heat rate of 10,000 Btu per kwhr, we would need $\frac{10,000}{400} = 25$ sq ft of surface to absorb the heat and to carry a load of 1 kw.

100 Sq Miles Needed to Generate Power

Last year the electrical load of the U. S. was about 100-million kw. Thus we would need 25 x 100 million = 2.5-billion sq ft of surface on the atmospheric envelope to meet our electric load demands.

This is a lot of surface. But we can convert it into some dimension which is more recognizable if we recall that a square mile contains approximately 5,000 x 5,000 = 25-million sq ft. Then, to meet our load we would need an area of $\frac{2.5 \text{ billion}}{25 \text{ million}} = 100$ sq miles.

The question naturally arises: "How big is 100 sq miles?" It is about ten times the size of Manhattan Island, or, as the area of the U. S. is more than 3,000,000 sq miles, approximately 1/30,000th of the country. By any criterion, this is a very small area.

Very naturally, these figures can be challenged: they are theoretical, i.e. hopelessly idealistic. Questions might be asked to this effect: "How do you propose to take care of the fact that you must get down on the ground and not be up above the clouds?" "How do you propose to handle the problem of bad weather—rain, snow, fog, clouds?" "How will you handle the night loads?" "How will you take care of variations caused by latitude and the 'wobble' of the earth in its celestial course?"

All of these problems, admittedly, must be solved. Even were it necessary to displace the decimal point and raise the 100 sq miles figure to 1,000 sq miles, the required area is still an unbelievably small figure.

Now, what can all this mean to us in the power business? We are spending vast sums of money on atomic energy, and yet we are a long way from reliable, economic, nuclear power. Would we not be well advised to spend some of our substance on equivalent attempts to break through the barrier on solar energy?

This does not imply any suggestions to curtail our nuclear weapons program. It would mean not only investigations for the development of sun engines but accompanying studies in related areas, such as electric transmission.

Transmission Progress Is Vital

Attempts to improve transmission over the last 10, 20, or 30 years have not kept pace with progress in power generation. If we could develop suitable transmission, there is no reason to preclude a solar power plant in the desert areas of the U. S. and delivery of electric energy to markets far away. Some persons will say that this is hopeless in view of the fact that there would be no local area protection.

Such arguments are vitiated when you take the viewpoint that steam, hydro, internal combustion, nuclear, and solar energy are complementary as well as competitive methods of generating power. Most power engineers recognize that the best costs and reliability generally stem from the diversified use of alternate sources. The era of the exclusively hydro system is largely obsolete.

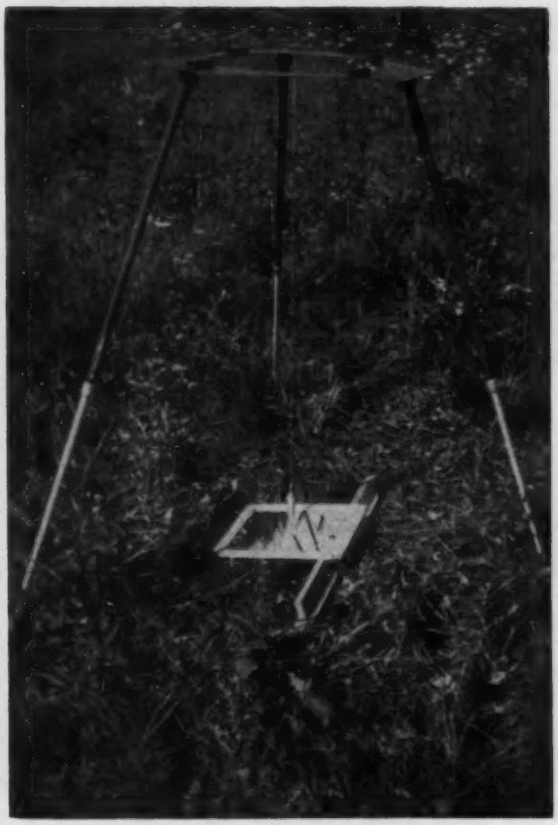
Plant Can Be 1,000 Miles from Load

So with the solar power plant, given better transmission, there is no fundamental reason why a source 1,000 miles away could not be used and tied in with hydro, steam, nuclear, and pumped storage to meet night loads and the vicissitudes of weather, climate, and latitude. In addition, the interconnection potentialities must not be forgotten as a step in the practical harnessing of the sun.

The essential point, however, is to recognize the magnitudes of solar energy and to ask the very question: "Why and when do we do something about it?"

If appropriations were made available with the lavish hand that favors the atomic power field, what kind of answers would our technologists bring forth to utilize directly the sun's energy for the generation of electric power?

BALLOON with target flag rises over angle point and when held in position transit man is notified by walkie-talkie



TRIPOD-MOUNTED RING, plumb bob, tilted mirror are spotted at each angle in line as in description on photos

TRANSMISSION—Design

Transfer Aerial Line Survey to Ground

W. A. HORTON, Engineer, Columbus & Southern Ohio Electric Co, Columbus, Ohio

A unique scheme is used to locate and stake routes of Columbus & Southern Ohio Electric Co transmission lines after they have been traced on aerial photographic enlargements.

Previous methods of transposing a route shown on a photographic mozaic to an actual line on the ground so that it can be used for right-of-way acquisition and clearing, have resulted in somewhat sawtooth tangents.

The plan in use, developed in cooperation with the Abrams Aerial Survey Corp, has advantages:

1. Increased accuracy permits full width of right-of-way to be cleared of timber, including dangerous trees, without re-surveying partially cleared areas.

2. Significant savings are made in time for plan-profile mapping and line staking, as these operations are now simultaneous.

3. Information obtained photogrammetrically can be checked more accurately, as the staked line coincides more closely with the line on the photos.

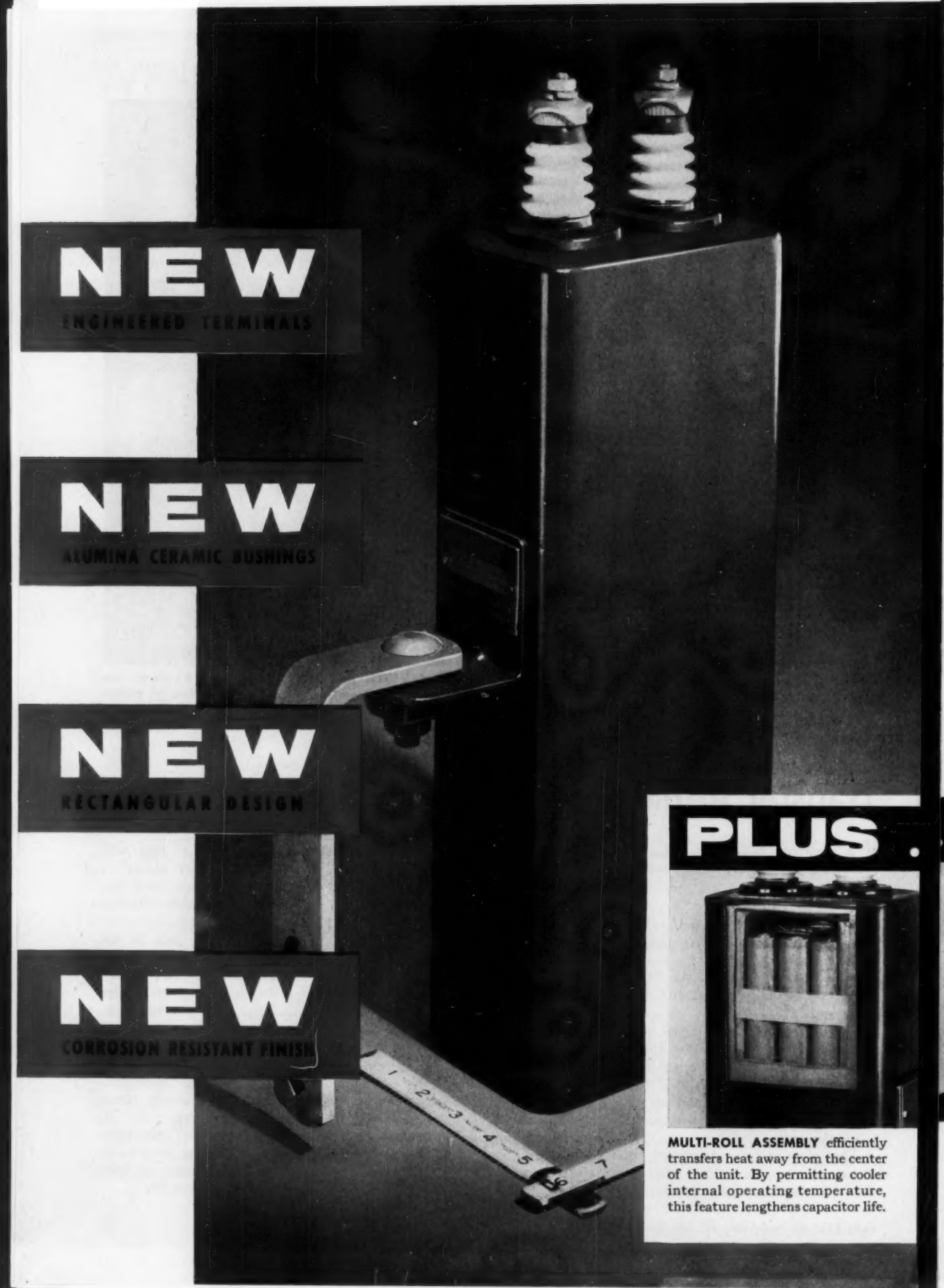
In the first step, a tacked hub is placed in the field at each angle point in the line according to its description on the photographs. Two men can stake ten to 15 angle locations in one day.

Secondly, an annular ring with piano wire cross hairs across its surface and mounted on three legs is set by using a plumb bob, the intersection of the cross hairs being directly over the tack in the hub.

A black dot on a plane mirror surface is then located exactly under the cross hairs and over the tack, and the mirror surface is tilted slightly from the horizontal.

While this setup is being made, a helium-filled, blimp-shaped balloon, with brightly colored target flag secured immediately below it, is allowed to rise over the angle point and is guided by three lightweight lines. The lines are han-

(*Continued on page* 66)


NEW
ENGINEERED TERMINALS
NEW
ALUMINA CERAMIC BUSHINGS
NEW
RECTANGULAR DESIGN
NEW
CORROSION RESISTANT FINISH
PLUS .
MULTI-ROLL ASSEMBLY efficiently transfers heat away from the center of the unit. By permitting cooler internal operating temperature, this feature lengthens capacitor life.

THE ALL NEW GENERAL ELECTRIC RESIDENTIAL SECONDARY CAPACITOR

for safer, longer, more economical service

Now General Electric offers a completely new secondary capacitor built to give longer, safer, more economical service on your residential feeders. Every new feature of this smaller and 33% lighter capacitor is especially designed to increase its electrical efficiency.

RECTANGULAR CASE, with flat sides to allow for internal expansion and contraction, permits complete impregnation of unit. This virtually eliminates the possibility of internal failure caused by voids in the liquid dielectric. The easy-to-install unit can be mounted in any position without changing the electrical strength.

SUPERIOR ALUMINA CERAMIC BUSHINGS provide four times the tensile and flexural strength, and five times the compression strength of old style wet porcelain bushings. A high-temperature brazing process bonds the bushing to a corrosion-resistant metal cap and flange.

NEW ENGINEERED TERMINAL provides a corrosion-resistant electrical connection that accommodates either copper or aluminum conductors up to #4 size. The two connector components are held tightly together by a brass nut and lock washer. Since the nut is made of softer metal, it will strip before the stud, if excessive torque is applied.

CORROSION-RESISTANT FINISH withstands rain, snow, salt-fog, and contaminated atmospheres. The entire capacitor—case, terminal, bushings and bracket—is fabricated from materials designed to resist corrosion, even under the most severe climatic conditions. Protective repainting will never be necessary.

The all-new G-E secondary capacitors are available in 3, 5, and 7½-kvar sizes. For more information, contact your nearest General Electric apparatus sales engineer or write for bulletin GEA-6670, General Electric Co., Section 445-10, Schenectady, New York.

Progress Is Our Most Important Product

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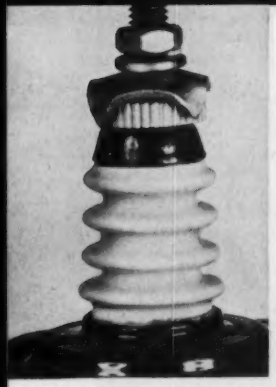
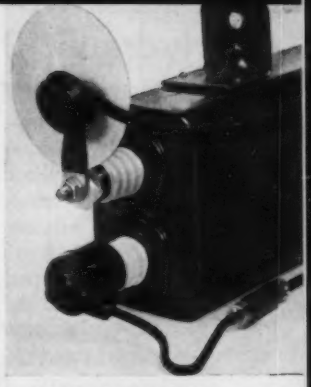
. . . THESE EXTRA FEATURES



BRAZED BUSHING FLANGE, spot welded and then heremetically sealed, eliminates need for gaskets.

SIMPLIFIED MOUNTING BRACKET meets EEI-NEMA lightning arrester-cutout specifications. Unit can be mounted with bushings up, down, or sideways; on the pole or on the cross-arm.

RED FLAG INDICATING FUSE (optional at extra cost) allows easy detection from the ground when current rating of fuse has been exceeded.



WEATHER-PROTECTED THERMOSTATIC SWITCH (also optional) automatically controls operation of capacitor.

Transfers Aerial Line

(*Continued from page* 63)

dled by three men spaced about 120 deg apart around the angle point.

The balloon rises high enough for a man sighting through a transit at an adjacent angle point to see the target flag. The target is then maneuvered by the hand lines until a man looking into the mirror from a position beside the ring can see the black dot, cross hair intersection, and target flag all in the same spot on the mirror surface. At this moment the transit man is notified by walkie-talkie radio and an azimuth is shot. These steps are repeated, and the azimuth readings are averaged in order to minimize any errors caused by sudden gusts of wind.

After a tacked hub has been placed at a distance from the transit for azimuth reference, the balloon and transit are moved along the line alternately to successive angle points, in a leap frog manner, until all azimuths have been staked. It is then merely a matter of setting up the transit over an angle hub and plumbing the line ahead, using the azimuth reference hub as a front sight. By placing orange-topped stakes at intervals along the line, clearing and right-of-way acquisition operations may proceed with minimum delay.

METERING—Testing

Saves on Meter Handling

HENRY G. NOLD, Detroit Edison Co, Detroit, Mich.

Hydraulic lift gates on trucks facilitate handling of meters from the central meter shop to the field. Meter trucks are loaded with tested meters at the test boards. The loaded meter trucks are rolled onto the hydraulic lift gate of the truck. The gate is raised to the truck bed level, and the meter truck is rolled into place in the truck.

In the field, the meter trucks are rolled off the truck to the hydraulic lift gate which is positioned so that the meter truck can be pushed directly to the storage area. Meter men work directly from the meter storage and handling trucks.

Meters removed from service are returned in the same manner. These operations have saved about $15,000 a year in handling and packing operations in the meter department.

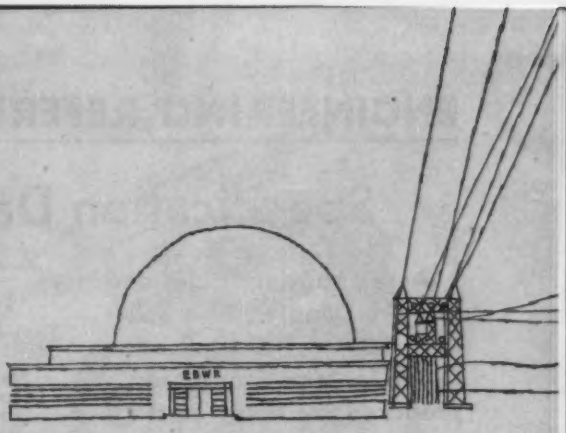
DISTRIBUTION—Construction

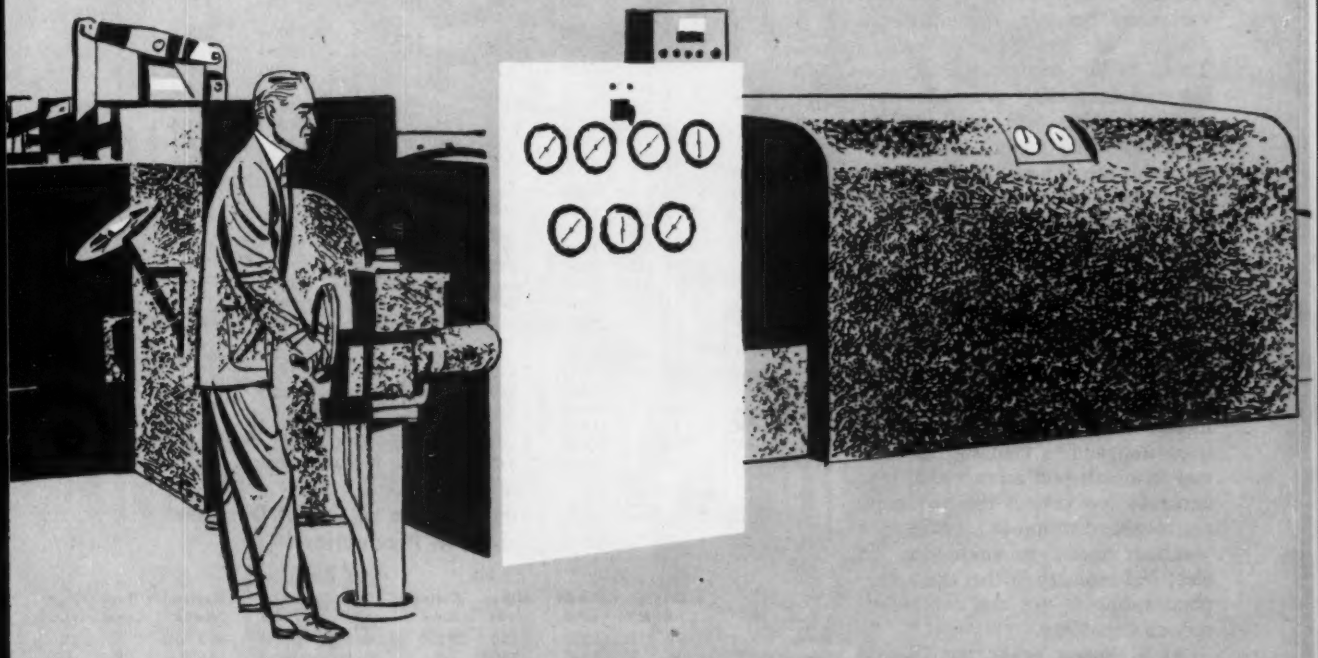
Hydraulic Derricks Prove Economical

Indianapolis Power & Light Co is going to hydraulic derricks for setting poles. Increased safety to men and savings in time justify the expense, according to Chester Moore, overhead line superintendent.

The hydraulic derrick eliminates assembling the conventional derrick and saves about 30 min on each job, said Moore. It also permits precision control in the setting of poles in a line on which primaries are energized. There is no exposed mechanism on the derrick.

STANDARD OIL PRODUCT HAS ROLE IN HISTORY-MAKING EVENT





Last December at Argonne National Laboratory, Lemont, Illinois, the Experimental Boiling Water Reactor achieved its design power level of 5,000 kw. for the first time. The lubricating oil in the Allis-Chalmers turbine was Standard's NONPAREIL Turbine Oil.

In a boiling water reactor, live steam is generated in the uranium core and piped to the turbine. There is no coal pile on the site and no ash heap. The reactor consumes less than an ounce of uranium in 24 hours. While the unit is regarded as a tool for research, it is now supplying an important part of the electrical energy required by this 2,700 man laboratory.

Near the turbine of this history-making research tool will hang a framed guarantee certificate. This document will certify that the 350 gallon fill of NONPAREIL Turbine Oil is *guaranteed for the life of the turbine*. More than 1,800 of these certificates have been issued; the first one more than 30 years ago. The guarantee still stands.

As with every NONPAREIL Turbine Oil installation, an additional technical service is performed. Standard Oil men with engineering training and long experience in lubrication work take samples of the oil for analysis twice yearly to make sure the oil continues to meet guarantee conditions. In the case of Argonne National Laboratory, industrial lubrication specialists from Standard Oil's division office in Joliet, only a few miles away, do this work.

Such service as this is available to you from your nearby Standard Oil office anywhere in the 15 Midwest and Rocky Mountain states. Call there. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)

Specification Data for Watthour Meters

Accompanying tables and text are adapted from Bulletin 161-12, "Application Guide for Watthour Meters", prepared by Rural Electrification Administration.

Table I and Table II illustrate variations between manufacturers' designs of single-phase meters. These tables cover meters manufactured since 1936. A trend toward standardization will be noted in Table II. The meters covered by this table are of new design and represent the latest models to be placed in production.

The two tables contain no indication of current capability of the meters except the nameplate rating in amperes. This rating is a design value to establish the rated speed and has no direct connection with the maximum load capability of the meter. After a watthour meter has been designed, a heat run on coils and terminals plus an extended load accuracy test reveals the maximum permissible continuous loading. The watthour meter is unique in the electrical industry in that the nameplate rating is not the continuous service capability.

As a general guide, the 15-amp meters listed in Table I are adequate for 60-amp services; those produced currently (Table II) are adequate for 100-amp services. For services between 100-amp and 200-amp, the 50-amp self-contained meter (or its equivalent)† is satisfactory. But the 50-amp meter should never be installed in a standard capacity meter socket. The almost certain result is a burned out meter caused by heating at the meter terminals. If the extra expense of the high capacity meter is warranted, it should be installed in a socket suitable for the load.

†Westinghouse Electric Corp does not manufacture a 50-amp watthour meter in Type D series. Westinghouse has determined that the type D, 30-amp meter with 667% loading capability is satisfactory for 200-amp loads. Reference should be made to the REA materials list for appropriate loading data.

Table I—Single-phase Meters of Recent Manufacture

Type	Design RPM	Speed RPH	Meter Volts	Rating Amp.	K_h	Reduction at Shaft Ratio	Register Ratio	Reg. Const.
Duncan MF	30	1800	120	2.5	1/6	75:1	800	1
Duncan MF	30	1800	120	5	1/3	75:1	400	1
Duncan MF	30	1800	120	15	1	75:1	133 1/3	1
Duncan MF	30	1800	240	2.5	1/3	75:1	400	1
Duncan MF	30	1800	240	5	2/3	75:1	200	1
Duncan MF	30	1800	240	15	2	75:1	66 2/3	1
Duncan MF	30	1800	240	50	6 2/3	75:1	200	10
GE I-30	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
GE I-30	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
GE I-30	16 2/3	1000	120	15	1.5	100:1	66 2/3	1
GE I-30	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
GE I-30	16 2/3	1000	240	5	1.2	100:1	83 1/3	1
GE I-30	16 2/3	1000	240	15	3.0	100:1	33 1/3	1
GE I-30	16 2/3	1000	240	50	12.0	100:1	8 1/3	1
GE I-30	16 2/3	1000	240	50	12.0	100:1	83 1/3	10
Sangamo J	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
Sangamo J	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
Sangamo J	16 2/3	1000	120	15	1.8	100:1	55 5/9	1
Sangamo J	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
Sangamo J	16 2/3	1000	240	5	1.2	100:1	83 1/3	1
Sangamo J	16 2/3	1000	240	15	3.6	100:1	27 7/9	1
Sangamo J	16 2/3	1000	240	50	12.0	100:1	8 1/3	1
Sangamo J	16 2/3	1000	240	50	12.0	100:1	83 1/3	10
West'house C	30	1800	120	5	1/3	8 1/3:1	3600	1
West'house C	30	1800	120	15	1	8 1/3:1	1200	1
West'house C	30	1800	240	2.5	1/3	8 1/3:1	3600	1
West'house C	30	1800	240	5	2/3	8 1/3:1	1800	1
West'house C	30	1800	240	15	2	8 1/3:1	600	1
West'house C	30	1800	240	50	6 2/3	8 1/3:1	180	1
West'house C	30	1800	240	50	6 2/3	8 1/3:1	1800	10

Table II—Single-phase Meters of Latest Design and Currently in Production

Type	Design RPM	Speed RPH	Meter Volts	Rating Amp.	K_h	Reduction at Shaft Ratio	Register Ratio	Reg. Const.
Duncan MK	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
Duncan MK*	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
Duncan MK	16 2/3	1000	120	15	1.8	100:1	55 5/9	1
Duncan MK	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
Duncan MK	16 2/3	1000	240	15	3.6	100:1	27 7/9	1
Duncan MK	16 2/3	1000	240	50	12.0	100:1	8 1/3	1
Duncan MK	16 2/3	1000	240	50	12.0	100:1	83 1/3	10
GE I-50	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
GE I-50*	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
GE I-50	16 2/3	1000	120	15	1.8	100:1	55 5/9	1
GE I-50	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
GE I-50	16 2/3	1000	240	15	3.6	100:1	27 7/9	1
GE I-50	16 2/3	1000	240	50	12.0	100:1	8 1/3	1
GE I-50	16 2/3	1000	240	50	12.0	100:1	83 1/3	10
Sangamo J-2	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
Sangamo J-2*	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
Sangamo J-2	10	600	120	15	3.0	100:1	33 1/3	1
Sangamo J-2	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
Sangamo J-2	10	600	240	15	6.0	100:1	16 2/3	1
Sangamo J-2	16 2/3	1000	240	50	12.0	100:1	8 1/3	1
Sangamo J-2	16 2/3	1000	240	50	12.0	100:1	83 1/3	10
West'house D	16 2/3	1000	120	2.5	0.3	100:1	333 1/3	1
West'house D*	16 2/3	1000	120	5	0.6	100:1	166 2/3	1
West'house D	16 2/3	1000	120	15	1.8	100:1	55 5/9	1
West'house D	16 2/3	1000	240	2.5	0.6	100:1	166 2/3	1
West'house D	16 2/3	1000	240	15	3.6	100:1	27 7/9	
West'house D	16 2/3	1000	240	30	7.2	100:1	13 8/9	1
West'house D	16 2/3	1000	240	30	7.2	100:1	138 8/9	10

*This rating not in production but has been included to provide the manufacturers' basic disk constant (K_h).

GET THE INSIDE STORY...

THIS NEW 8-PAGE BOOKLET TELLS WHY **ROEBLING TELLURIUM LEAD ALLOY SHEATH** LASTS LONGER!

90% less creep... 4½ times greater bending life... unusual stability under heat... negligible age-hardening—you've read how Roebling Tellurium Lead Alloy Cable Sheath has all these favorable, life-saving qualities, and more. Now the full story, complete with useful technical data, is told in an illustrated 8-page bulletin that's free for the asking.

Learn how cable maintenance problems can be materially reduced, with savings. Send for your copy of this informative book today!

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION
Electrical Wire Division
Trenton 2, New Jersey

Please send me your new Tellurium Lead Alloy Sheath Facts Book.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State____

SURVEY REPORT told Con Ed what electrical living conveniences New York City apartment wives wanted, . . .

AND COMPACT ALL-ELECTRIC KITCHEN was designed around requirements. It features appliances and lighting

Con Ed Unveils All-Electric Apartment Kitchen

Consolidated Edison Co recently took the wraps off a modern, all-electric kitchen designed around what New York City apartment women say they want.

This is the result of Con Ed's "So We Asked the Ladies" survey (EW, Feb. 4, 1957, p 76), in which the company tried to find out what apartment wives wanted in the way of electrical living conveniences that their counterparts in single-family dwellings enjoy.

The compact kitchen fits in an area 10 ft 5 in. wide by 11 ft 9 in. long. All major appliances are "built-ins", giving plenty of counter and cabinet space (top-priority items on the ladies' lists). These include a wall-type oven; counter-type range; dishwasher; washer-dryer combination; and a refrigerator with a freezer compartment.

Inadequate lighting was another of the ladies chief gripes, according to the survey. So the new kitchen has under-cabinet lighting in all working areas over the range, sink and counters. Cooking odors are sucked out with a ventilating fan, and there are plenty of plug-in outlets to handle smaller appliances and housewares. The kitchen also has ample space for a dinnette area.

The all-electric kitchen is important to the big utility because a large hunk of its residential meters (70%) are in apartment houses.

Immediately after Con Ed published the results of its "So We Asked the Ladies" survey, it established an Apartment House Division to advise on kitchen sign and other electrical features. The kitchen is the work of this division.

SPS Offers New Upped Wiring Code

TOM LYNN, Lighting Specialist, Southwestern Public Service Co, Amarillo, Texas

A recommended electrical code is being offered by Southwestern Public Service Co to city officials and electrical industry groups in its service area. The 17-page code complements Southwestern's adequate wiring program.

Since the recommended code was made available, at least four cities have set up and placed in operation electrical codes which closely parallel ours. Several other towns have begun studies for new codes or revisions of their old ones.

The new code covers many wiring practices. Although it is not considered ideal by some authorities, it generally is far superior to most present-day practices. Included as residential requirements are:

- 70-amp, 3-wire minimum service entrance.
- No. 12 as minimum size conductor for branch circuits, adequate grounding of the wiring system, and certain appliances.
- No. 6 conductor for electric range wiring.
- Four-outlet limit for appliance circuits.
- Eight-outlet limit for general-purpose and lighting circuits.

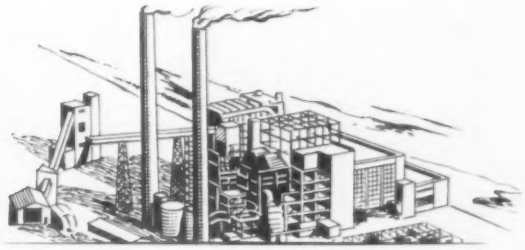
Requirements for commercial wiring are also covered, with recommendations for conduit and maximum number of outlets per circuit.

The new code resulted from a study by Southwestern of the National Electrical Code, codes used in other cities, and practices consistant with our adequate wiring program. We also consulted with contractors, distributors, and their trade associations.

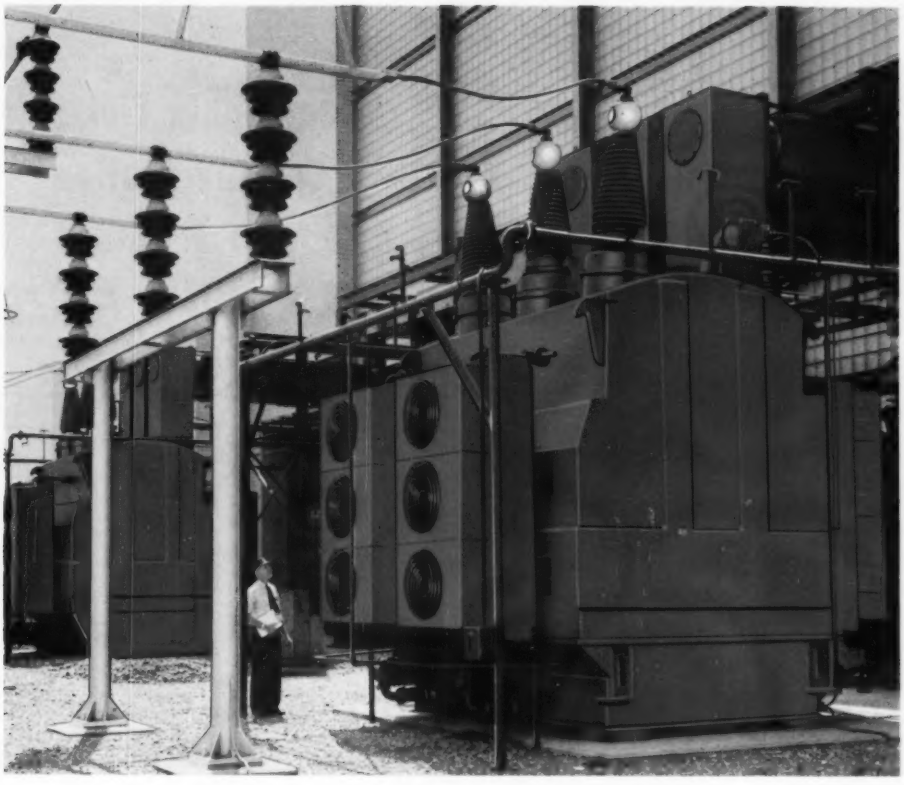
(*More Selling on page* 73)

240,000 Kva

ON UNIT NO. 2 at CROMBY



Philadelphia Electric chose PENNSYLVANIA!



TWO 120,000 KVA PENNSYLVANIA POWER TRANSFORMERS were selected for main step-up service on generating unit No. 2 at Philadelphia Electric Company's Cromby Station. The transformers have a high voltage rating of 145,000 Grd.Y volts and a low voltage rating of 19,800Δ volts.

Located on the banks of the Schuylkill River near Philadelphia, Cromby Station has a potential generating capacity of 385,000 kw. This represents approximately 15% of the total effective system generating capacity of Philadelphia Electric Company.

Serving as important links in this newest addition to Philadelphia Electric's system, two three-phase, 120,000-kva Pennsylvania Contour Design Power Transformers step up the generated voltage of 19,800 volts to a transmission voltage of 145,000 volts. The shell form transformers were designed to operate during flood water levels up to four feet above the transformer bases.

In keeping with Pennsylvania Transformer practice, both transformers were shipped to Cromby in an upright position, completely assembled except for bushings and forced cooling equipment.

You, too, can rely on Pennsylvania to satisfy the most exacting power transformer requirements. For a discussion of problems or a quotation on your next installation, write to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

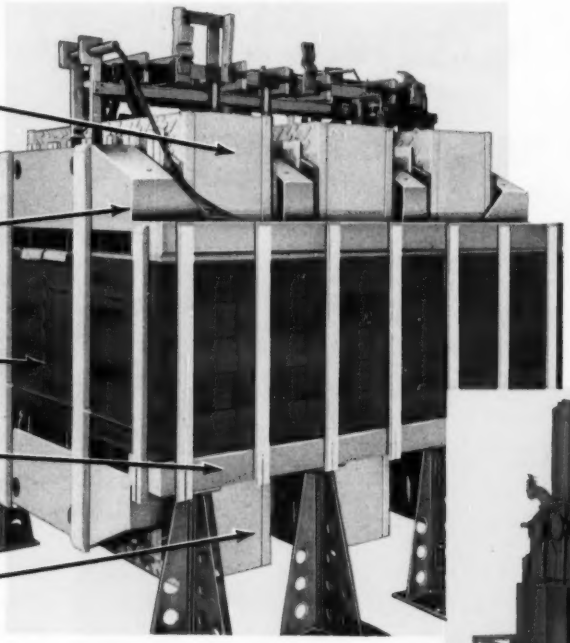
PENNSYLVANIA POWER TRANSFORMERS

See next page for design details

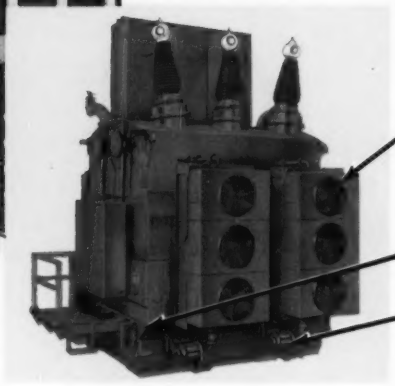
120,000 Kva PENNSYLVANIA

CONTOUR DESIGN—GENERATING STATION

Power Transformers . . .


Core-and-coil unit is a completely integrated sub-assembly.
Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.
Core cooled by both vertical and horizontal ducts.
Core-and-coil assembly rests on bottom section of tank.
Vertical cooling ducts in the coils permit a free flow of oil through the coils.

MEET THE CHALLENGE at Philadelphia Electric's Cromby Station


Transformer cooled by means of four forced-oil to forced-air heat exchangers.
Upper section of tank fits over core-and-coil assembly and is welded to bottom section at this point.
Pennsylvania Seal-Master® Pump is self-contained, self-lubricating, and has integral motor-pump shaft.

One of two such transformers on generating unit No. 2 at Cromby. 120,000 Kva, Three Phase, 60 Cycles, 55°C. Temperature Rise. Forced-oil to forced-air heat exchangers. High voltage: 145,000 Grd. Y volts. Low voltage: 19,800Δ volts.

PENNSYLVANIA HAS THE *FACILITIES* AND THE *CAPABILITY* TO MEET THE LARGEST POWER TRANSFORMER REQUIREMENTS

- A large, expertly-staffed engineering department with long experience in power transformer design — both core form and shell form.
- The ability to design and construct full-scale test models for proving design characteristics.
- A modernly equipped plant capable of producing and testing the highest rated units contemplated by the industry today.
- Handling and loading facilities that permit full utilization of manufacturing, shipping and installation economies.

OTHER PENNSYLVANIA TRANSFORMERS AT CROMBY STATION

Auxiliary Power Transformers—Two 7500/9375 kva, 20—4.16 kv units.
One 10,000/12,500 kva, 34.4—4.16 kv unit.

Load Center Transformers—Three 250 kva, 4160—120/240 volt Silicone-Insulated, sealed dry type units.

Making a total of 272,000 kva in transformer capacity supplied by Pennsylvania Transformer

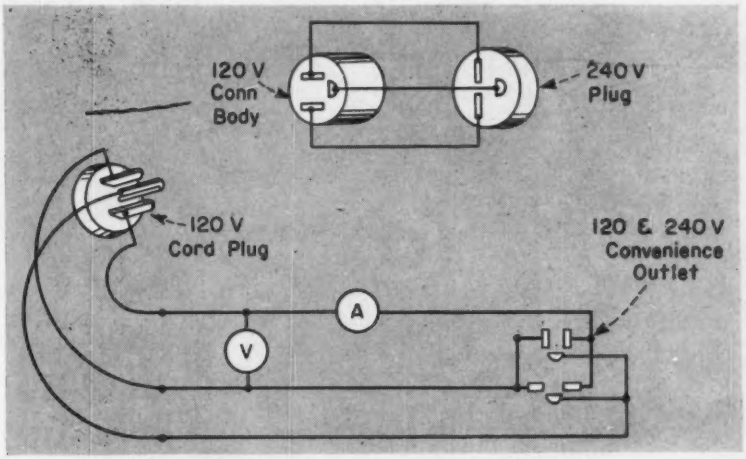
PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA TRANSFORMER DIVISION

McGraw-Edison Company

CANONSBURG, PENNSYLVANIA Greater Pittsburgh District

See other side for installation view



VOLTAGE ADAPTER CONNECTIONS for room air conditioners are shown above. Adapter permit plugging into either 120 or 240-v outlets

Build Compact A.C. Tester

F. MAX CHITTENDEN, Instrument Technician, Consumers Public Power District, Lincoln, Neb.

In order to cut down on customers inconvenience and avoid a lot of messy apparatus, a compact test unit was developed by the author for checking or preliminary testing of window-type air conditioners right on the customer's premises. The unit easily fits in out-of-the-way places, where it is not an annoyance to the customer. It also makes a presentable appearance, which can be important

The air conditioner motor, whether it is 120 or 240 v, can be quickly plugged into the dual-voltage receptacle for reading current and voltage. Large scales allow easy reading and comparison of nameplate ratings.

The 250-v voltmeter, 30-amp ammeter, and dual-voltage convenience outlet are mounted on a thin panel fastened to wood strips secured to the sides of a standard instrument case. A compartment behind the panel, accessible from the back flap, contains three No. 14 conductor leads, each 4 ft long, and two adapters for the grounding type lead plug. These adapters permit plugging the test unit into either 120 or 240-v outlets.

Arkansas P&L Sets Special Electric Heat Rate

Arkansas Power & Light has reduced its rates for electric home heating. The new rate applies to home and farm customers who have installed heat pumps or at least 4 kw of resistance heating. It went from 1.9¢ to 1.2¢, for a 36% drop.

According to APL&L vice president W. M. Shepherd, "This new, low rate reduces the cost per kwhr to 1.2¢ for all usage in excess of 500 kwhr a month. This reduces the cost for heating purposes by 0.7¢ per kwhr, or more than ⅓. It is the first time that the company has offered a special wintertime rate that puts electric heating within the reach of thousands of our customers.

"This special heating rate opens the door for many customers who will find it desirable because of the comfort, cleanliness, safety, and low cost of installing and using electric heat."

Regular rates apply for all usage below 500 kwhr a month.

To prepare the anticipated effect of the rate change, AP&L has trained a battery of its sales people as electric heating specialists.

(*More Selling on page* 74)

For "small-job sealing"...

Johns-Manville

Duxseal

in the new handy pocket roll

THE NEW HANDY pocket roll makes Duxseal® ideal for small sealing jobs in both installation and maintenance work. It thereby increases the usefulness of your favorite all-purpose sealing and caulking compound.

The NEW pocket roll container allows quick removal and replacement of the compound. Its ribbon form makes Duxseal easy to apply in any amount, large or small.

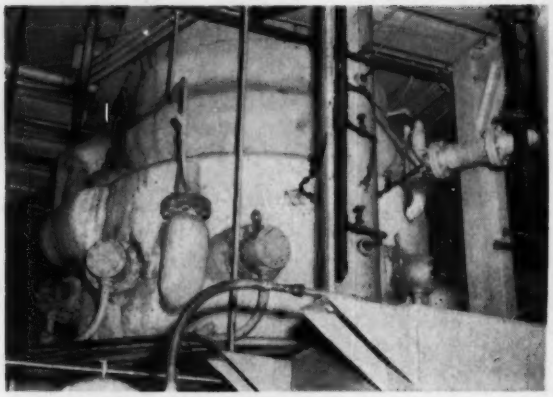
3 types of Duxseal are now available in pocket rolls:

- **STANDARD DUXSEAL** is a permanently plastic gray-green compound utilizing a non-drying, vegetable-oil vehicle. It will not corrode metals, plastics, wood, rubber, or painted surfaces. It adheres well to all common materials. It is non-staining.
- **TYPE N DUXSEAL** has the same properties plus higher resistance to bleeding or dripping at high temperatures.
- **R-100 DUXSEAL** employs a resinous material as its vehicle and has the same properties. It skins fast to provide an excellent paint surface.

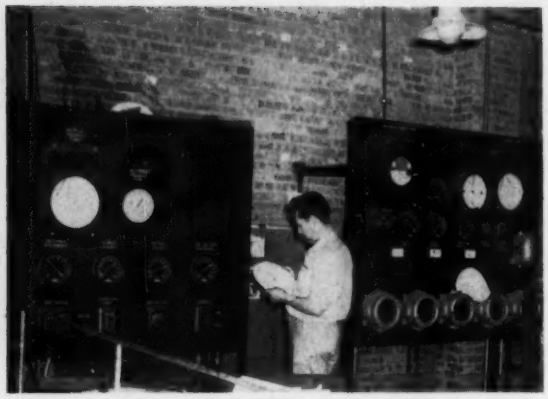
A wide range of other J-M Sealing Compounds is also available in pocket rolls. These are described in sheet EL-85A. Duxseal is covered in sheet EL-68A. Write Johns-Manville, Box **14,** New York 16, N. Y.

Johns-Manville

DUXSEAL



Compact electric vapor-heated kettle . . .



. . . with precise temperature control . . .

Boosts Output and Quality in Crowded Plant

GEORGE A. SOULE, Power Sales Engineer, Commonwealth Edison Co, Chicago, Ill.

Despite space limitations, McWhorter Chemicals, Inc, was able to get added capacity for production of resins, varnishes, and specialty chemicals by installing an electric vapor heated kettle. The flameless electric heat is completely safe although there are volatile products and fumes in the production area. The precise temperature control possible with electric heat is another advantage in producing resins for industrial and architectural paints, one of the kettle's principal uses. And the electric kettle is 10% faster than a comparable gas model in bringing reactants up to heat. Moreover, product quality is improved by the new unit.

Nine 30-kw heating elements, immersed in a Dowtherm reservoir at the base of the unit, heat the Blaw-Knox Electrovapor kettle. The heaters operate at 230 volts, 60 cycles. A coil in the 1,000-gallon process tank can carry either steam for heating the contents or water to cool them. Additional coils, located in the Dowtherm near the heating elements, can also be used.

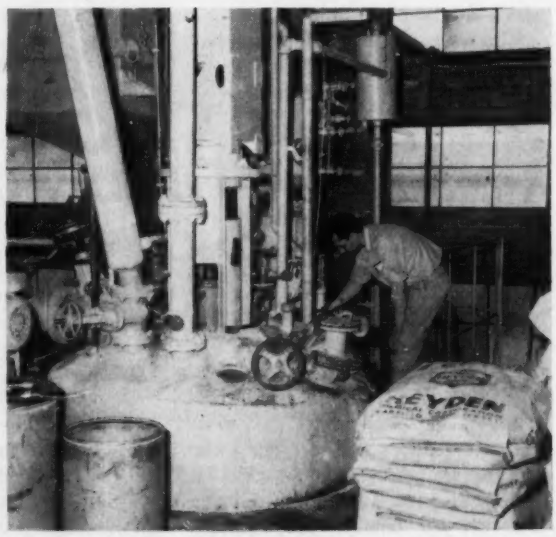
The electric kettle is a general purpose unit, with many auxiliary features, and can be used for a wide variety of products. In addition to producing resins for paints, it is also used to heat convertible resins and polyesters for molding and fabrication. Most of the processes are sterifications.

With a 5,300-lb charge, the electric kettle can raise reactant temperature from a cold start to 475 F in two hours. Reaction temperatures vary from 300 F to 575 F, according to the product. During the heating period, water of reaction is boiled off. The kettle usually remains at operating temperature for five to eight hours to complete the product.

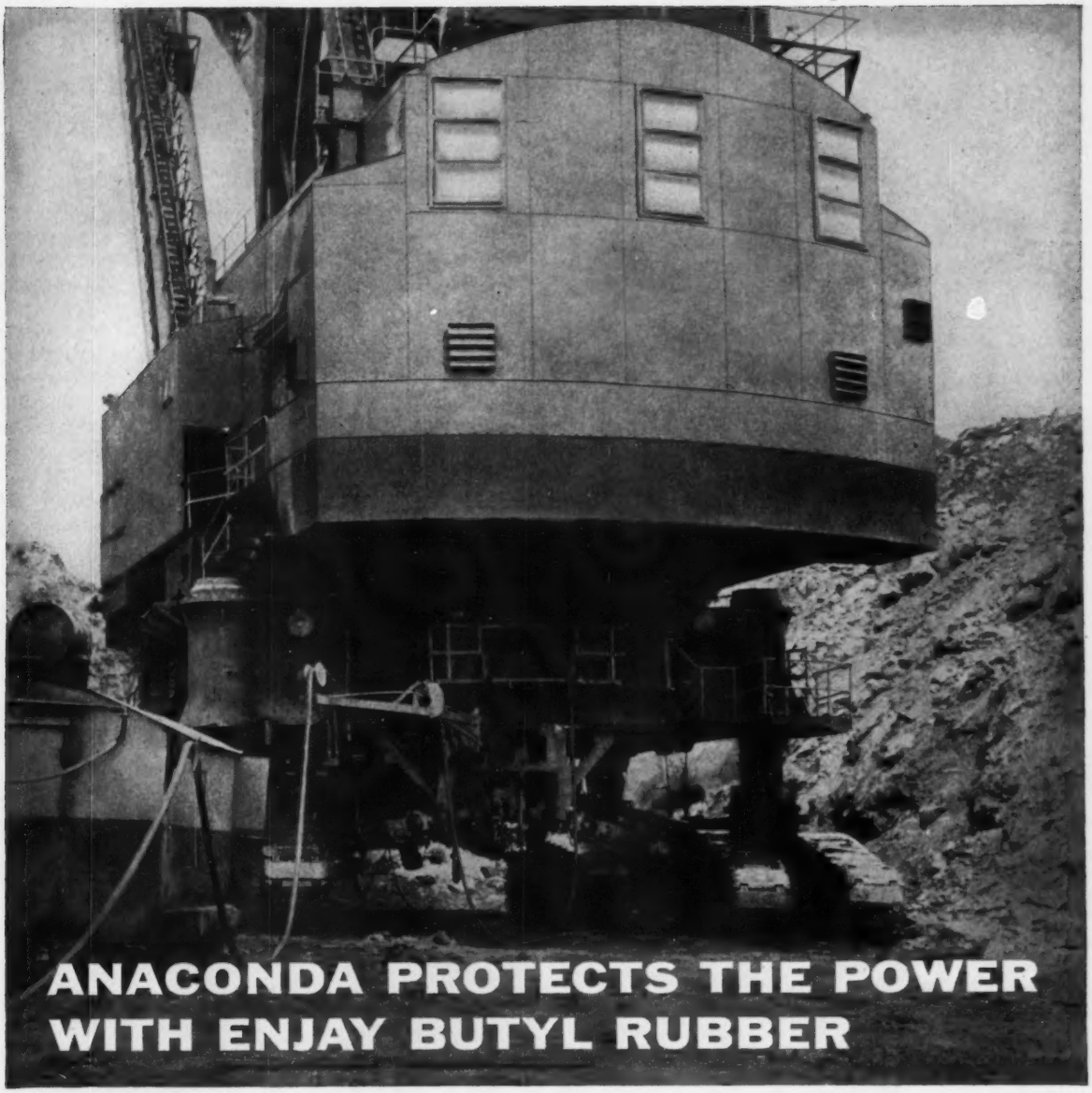
According to Charles McWhorter, president of the company, the existing gas kettle was about 10% slower than the new electric unit. Because there is no overrun problem with the electric kettle, the heating elements can remain on until the contents are nearer the top temperature before heat is cut off for "coasting in."

Existing equipment before the new installation included a Dowtherm vapor-heated kettle with a separate, gas-fired boiler. Because of the nature of the manufacturing process, with the volatile products and fumes in the production area, any open-flame equipment would have to be located in a separate building. In addition to the increased cost, the company had no space available for such a building.

"Electrovapor is ideal for our processing", says McWhorter. "We get exact control of temperature and can control reaction rates precisely. A higher quality product is being produced in the electric kettle."



BETTER CONTROL OF REACTION rates is a bonus from electric heat. Process is checked from top of 1,000-gal kettle.



ANACONDA PROTECTS THE POWER WITH ENJAY BUTYL RUBBER

Talk about impact resistance! The 5-year-old Anaconda cable supplying this giant shovel with power was buried under thousands of tons of rock when a whole wall of the open pit mine caved in . . . *yet the cable continued to supply power!* This is one of the many Anaconda products featuring Enjay Butyl for *outstanding* performance.

Enjay Butyl is *unmatched* in its resistance to impact and abrasion, moisture and weathering, ozone and corona . . . properties that make it the world's outstanding rubber value.

Low in cost and immediately available in a grade tailor-made for *your* electrical application, Enjay Butyl is *the* rubber to boost performance and cut costs. For further information, and for expert technical assistance, contact the Enjay Company.

ENJAY *Pioneer in Petrochemicals*

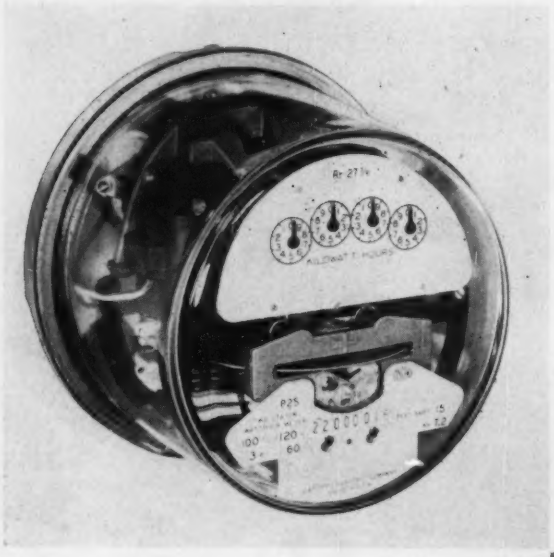
ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

Akron • Boston • Chicago • Detroit • Los Angeles • New Orleans • Tulsa

ENJAY BUTYL

Enjay Butyl is the world's greatest rubber value . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

NEW EQUIPMENT



Network Meter . . .

. . . **is two-stator type** with 8⅓-rpm full load speed and extended load range. This socket-type polyphase watthour meter starts at 0.25% of rated load, operates continuously at 666.66% rating with temperature rise of 50 C maximum. Without special calibration, registration is accurate for variations from 42% to 125% rated voltage, permitting 240-v model to be used on 120/208, 240/416, and 277/480-v systems.

Designated Type P2S, it has separate adjusting screws for full load, light load, and balance adjustment. Low height allows use of standard single-phase cover. Slow full load speed also improves electrical and mechanical characteristics. Other features are ease of assembly, improved visibility, stable calibration.

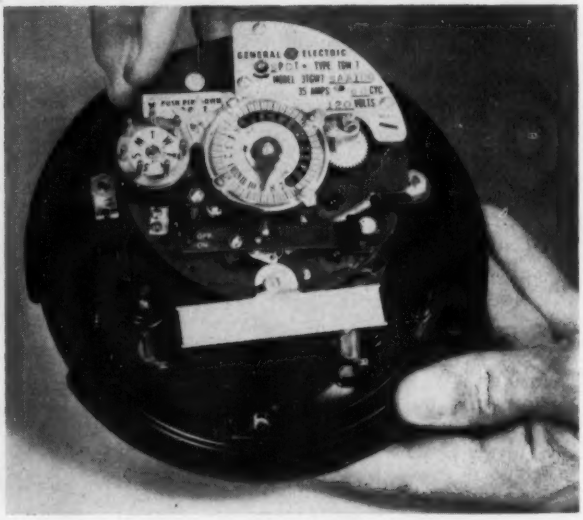
Sangamo Electric Co, Springfield, Ill.

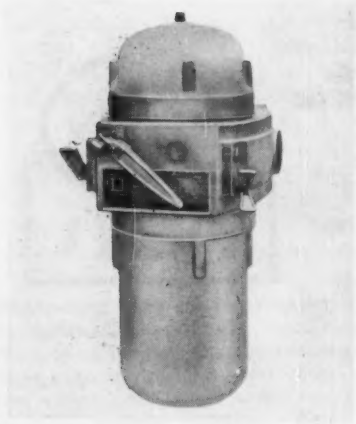
Time Switch . . .

. . . **for auto-switch capacitor equipments** controls oil or vacuum switches used on pole-top and substation equipments. This simple control has sealable opening for time-setting and a "push-pull" device to omit switching on selected days of the week.

Two sets of trippers provide two "on-off" operations daily. Extra trippers and 240-v control can be furnished. Timing and driving mechanism is high torque motor with permanent lubrication. Contact assembly is quick-make, quick-break unit, rated 35 amp, ac. All control switch connections are brazed for circuit continuity.

General Electric Co, Schenectady 5, N. Y.





Motor Starter Enclosure . . .

. . . **has explosion resisting design** for use in Class 1, Groups C and D and Class 2, Groups E, F, and G installations. Dust-tight and weatherproof, with threaded joints, it may be used outdoors. The cast, high density aluminum enclosure comprises a lower tank, an upper tank, and a collar section, either with or without a breaker operating mechanism.

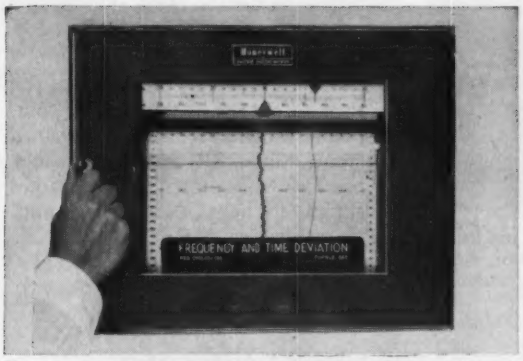
Plugged and tapped opening permits addition of drain and breather. Collars are tapped and plugged for reset mechanisms, pushbuttons, and selector switches. One enclosure size fits Size 0 or 1 starters, the other takes Size 2.

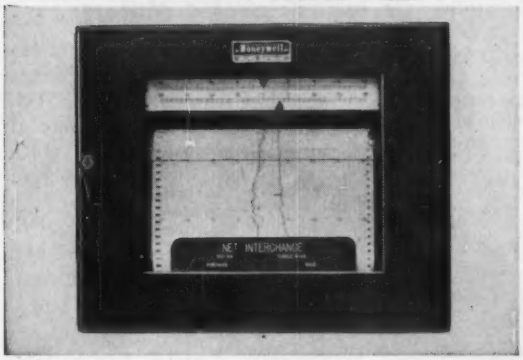
Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

Al Joint Compound

. . . **stops formation of high resistance aluminum oxide** by sealing contact area from air. Known as Cual-Aid, it is grease-base compound with metallic particles and is applied before joining conductor and

(*Continued on page* 78)

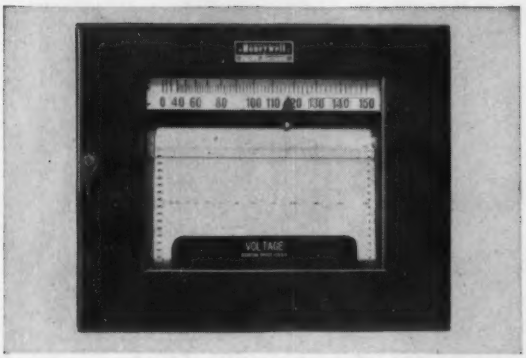


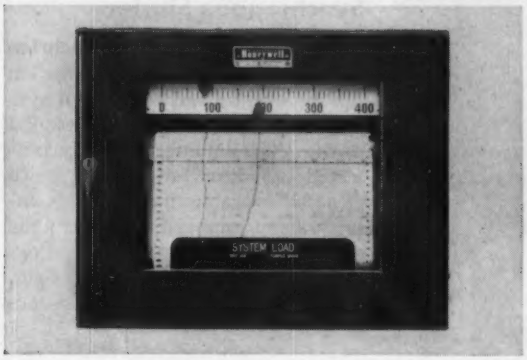


ElectroniK instruments can record...

- system load
- net interchange
- voltage
- frequency
- time deviation
- total generation
- station generation
- tie line loads
- sky illumination
- outside air temperature
- outside humidity
- wind velocity
- wind direction

Data recording instruments...to deliver dependably the facts your dispatcher needs





WHAT are the facts that your dispatcher should know, to keep up with what's going on in your system?

Variables important to him are listed above, and *ElectroniK* instruments record and indicate these variables with the precision, speed and sensitivity that you expect of Honeywell instruments . . . plus the dependability that you demand of all your equipment.

Your maintenance men will rarely have to perform more than periodic preventive service when *ElectroniK* instruments are at work. Every component is engineered for continuous service, with ample extra ruggedness. You can depend on *ElectroniK* instruments to deliver uninterrupted performance week after week. They have a reputation for staying on the job, in dispatchers' offices, power stations and in thousands of industrial plants.

Ask your local Honeywell field engineer to talk over the ways you can use these instruments in your own system. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

● **REFERENCE DATA:** Write for Bulletin 9070, "Instruments for Electrical Power Generation."

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

What Makes RT&E Transformers Better?

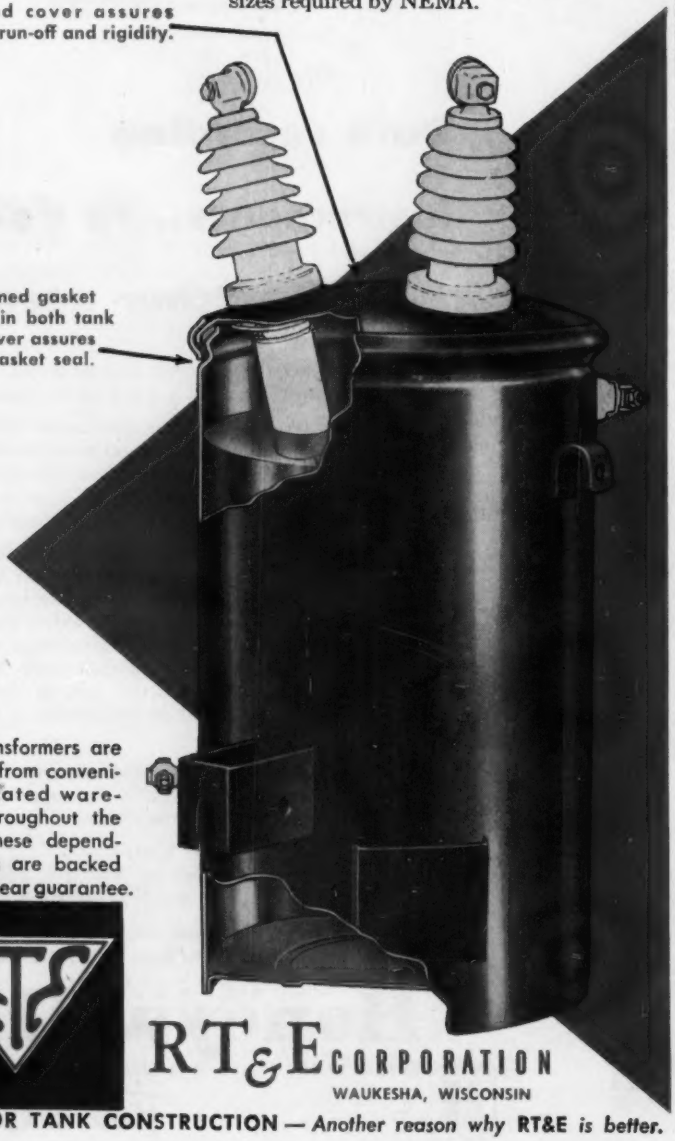
SUPERIOR TANK CONSTRUCTION
for longer Trouble-free life

RT&E tanks get three coats of modified alkyd paint — two coats flowed on, final coat sprayed — and each coat individually baked. This thoroughness provides the highest type of weather resistance. Arc welding of all seams, brackets and mounting pads, eliminates moisture traps and corrosion.

These heavy gauge steel tanks, with circular grooved bottoms, assure extra strength. Tin plated, locked type terminals accommodate either copper or aluminum conductor in the full range at sizes required by NEMA.

Domed cover assures water run-off and rigidity.

Preformed gasket surfaces in both tank and cover assures tight gasket seal.



RT&E Transformers are available from conveniently located warehouses throughout the nation. These dependable units are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

SUPERIOR TANK CONSTRUCTION — *Another reason why* **RT&E** *is better.*

Al Joint Compound

(*Continued from page* 76)

connector. Aluminum surfaces are then wire-brushed through the compound which keeps air from cleaned areas. Material is non-inflammable, has 350 F flash point, and does not stiffen to jelly consistency until chilled below 25 F.

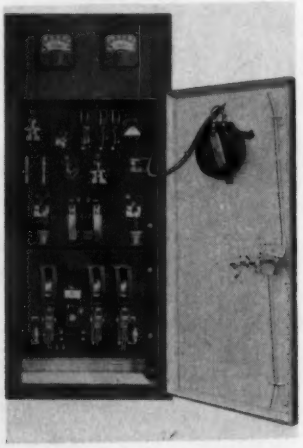
Penn-Union Electric Corp, Erie, Pa.

Industrial A-c Motors . . .

. . . **in 40 to 125-hp ratings are extension** of Life-Line series. Frames include sizes from 364U to 445US. Motors are designed to operate at 25, 50, and 60 cps on 220, 440, and 550 v. Speeds are 3,600 rpm and below.

Totally enclosed fan-cooled, totally enclosed non-ventilated, and drip-proof enclosures are offered. Motors have increased horse power for given frame size.

Westingouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.



Synchronous Starter . . .

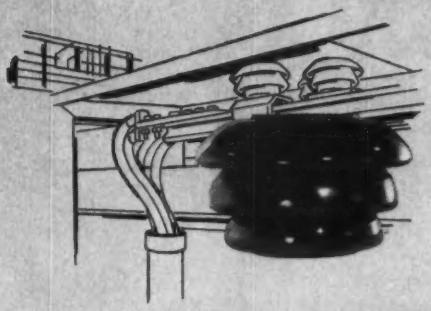
. . . **with fully automatic synchronization,** gives complete protection during starting and running of synchronous motors. Ratings cover 2.2 to 4.8 kv. Windings are fully protected; synchronization takes place at most favorable time. Field is automatically removed if motor pulls out of step. Re-synchronization occurs when motor re-accelerates load. Current limiting fuses in conjunc-

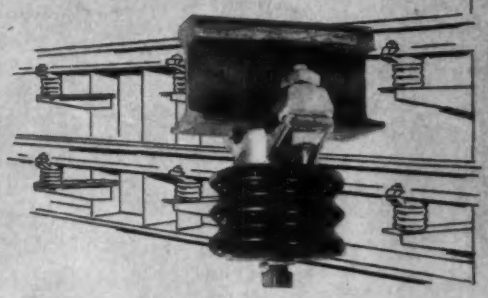
(*Continued on page* 80)

STRENGTH

Which kind of strength do you need in insulators for traveling-contact equipment?

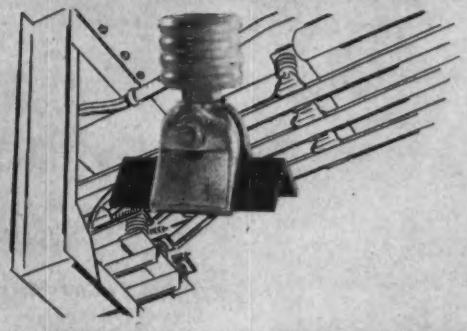
MAXIMUM ELECTRICAL STRENGTH





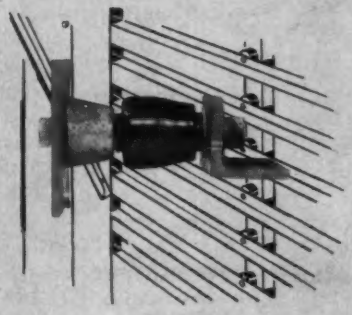
Wet-process porcelain insulators, such as these, offer outstanding electrical properties for high-voltage contact-rail insulation. Especially recommended where dirt, moisture, and other contaminants prevail.
Also available are dry-process porcelain units for power circuits.

MAXIMUM IMPACT STRENGTH



Molded polyester-fiberglass insulators and fabric-reinforced insulators of this general type have exceptional impact strength and vibration-resistance combined with good electrical properties. Tailored to resist chemicals, thermal shock, weathering.

MAXIMUM TENSILE STRENGTH



Molded Giant Strain insulators, adaptable to miniaturization where space is restricted, offer unusual mechanical strength. A very economical insulator having diverse applications.

TO HELP YOU DECIDE . . .

. . . on the right combination of properties to meet your insulator needs, Delta-Star engineers from coast to coast invite your problems. Phone the nearest Delta-Star district office or write to Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa.

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Name ..... Title .....
Company .....
Address .....
City ..... Zone ..... State .....

Synchronous Starter

(*Continued from page* 78)

tion with high interrupting capacity air-break contactors provide short circuit protection.
Electric Controller & Mfg Co, 4500 Lee Rd, Cleveland 28, Ohio

Silicon Rectifiers . . .

. . . **rated 35 and 22 amp halfwave,** respectively, have 600-v max peak inverse voltage. At 25 to 35 C ambient temperature, Model 302 has maximum forward drop of 0.9 v with 10-amp current; Model 303 has 1.2-v drop. They are available in complete bridge assemblies.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Transformer . . .

. . . **for hazardous areas** is steel encased, filled with compound, and of all-welded construction to make it as near explosion-proof as possible. Available with maximum ratings of 600 v in sizes through 15 kva, it is specially designed for the petroleum industry. Units may be used indoors or outdoors. They are supplied with either conduit nipples and "pig-tail" leads or enclosed terminal box with conduit knock-outs.
Standard Transformer Co, Warren, Ohio

Textile Motor . . .

. . . **in enclosed, non-ventilated design,** is smaller and lighter. Using Tri-Clad "55" construction, the motor is rated for continuous operation with 75 C temperature rise to obtain maximum horsepower from smallest possible frame size. Enclosed, non-ventilated design minimizes fire hazards by preventing lint from reaching windings. Motor is practically maintenance free. Intended for picking and carding machines, spinning and roving frames, spoolers, warpers, and slashers, motor is available in 1.5, 2 and 3 hp models.
General Electric Co, Schenectady 5, N. Y.

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Holan's new Series 6800 Derrick with Extendible Boom Head has double-acting cylinder which extends derrick head an extra five feet ... from 23 feet to 28 feet. Derrick lifts heavy loads in low ranges ... comes low enough to power feed diggers. Body-loading capacity: 4,000 pounds.
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To J. H. Holan Corporation
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Please send me complete technical information about Holan's Series 6800 Power Derrick.

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New..Delta-Star Heavy Duty Aluminum Connectors!

Delta-Star announces a complete new line of connectors. Extra rugged construction and engineered for maximum service life under all conditions... Particularly important in this new line are the heavy walls and generous overall dimensions. With these features pressure is distributed to permit optimum contact yet with negligible cold flow...All sizes and ranges of conductors are cast on surface of each connector...Can be supplied in types and sizes to meet all connector requirements. For further information, write Delta-Star Electric Division, H. K. Porter Company, Inc.—2437 West Fulton Street, Chicago 12, Illinois.

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ENGINEERING MEMO FROM KAISER KW WIRE **6.1**

[ANOTHER KW PRODUCT DEVELOPMENT]

AAAC*...ALL-ALUMINUM ALLOY CONDUCTOR

BY

NEIL BARR
Chief Engineer—Electrical Conductor Division

H. S. SPAULDING
Assistant Chief—Corporation Metallurgical Dept.

ANDREW L. KOLB
Manager Electrical Product Development Department

E. W. GREENFIELD
Head, Electrical Engineering Department, Division of Metallurgical Research

The lower cost and availability of E.C. aluminum and ACSR and their excellent performance record have resulted in their increased use as transmission, distribution (primaries and secondaries) and service drop conductors. In lines being constructed today either all-aluminum or ACSR is probably used in 95% of transmission, 50% of distribution and 60% of service drops.

In transmission lines the cost of high strength structures, with associated insulators and accessories, usually necessitates the use of high strength conductor when economics are considered. ACSR has for many years satisfactorily filled this need. Transmission lines have relatively few taps or other connections and their importance justifies the use of the best available accessories such as compression splices and dead-ends. Since transmission line rights-of-way are usually cleared of all obstructions, they are seldom bothered by falling trees or sleet-loaded tree limbs. Conductor repairs are not often required.

Distribution lines with their many taps and connections of all kinds present a different problem. It is not always possible to trim trees, so sleet storms and high winds usually result in considerable conductor damage due to swinging or falling branches. With the many taps and more frequent conductor repairs, the steel-cored ACSR does present some problems, especially when it is desirable or necessary to do live line repair work. Due to new building projects and added load, it is frequently necessary to revise or rebuild distribution circuits.

In some instances E.C. aluminum conductors can be used in distribution circuits, but in the smaller sizes, usually in the heavy loading district, additional strength is frequently required. To date, this strength requirement has been fulfilled by using ACSR with the associated problems of splicing, dead-ending and repairs.

Conditions outlined above pointed to the need for a satisfactory high-strength aluminum conductor that would enable users to take advantage of the cost differential between aluminum and copper. We believe a high-strength high-conductivity aluminum-magnesium-silicon alloy conductor such as we have developed over the past years meets these requirements. Some of its advantages are listed below:

1. Increased strength over E.C. aluminum
2. One-piece splice develops full strength
3. Simple to dead-end
4. Emergency splices can be made with automatic type units
5. Lighter in weight than ACSR
6. One metal, which alleviates galvanic corrosion possible with ACSR in some highly corrosive atmospheres
7. Desirable electrical characteristics —especially a-c/d-c resistance ratio, which is about 1.00, the same as for copper or its equivalent E.C. aluminum as compared with about 1.25 for some of the larger sizes of ACSR made of one layer of aluminum over a single solid steel core wire.

Since ACSR satisfies strength requirements with a practical size, an alloy which has a strength and conductivity equal to these composite properties of ACSR will also be satisfactory. The examples in Table I show what these properties of the alloy should be.

Therefore, with the strength of the aluminum strands as 25,000 PSI, and that of the steel (at 1% extension) as 170,000 PSI, the average tensile strength of the conductor is 45,700 PSI.

The initials AAAC are not a trade-mark of Kaiser Aluminum, but are regarded as a grade designation for All Aluminum Alloy Conductor (developed by Kaiser Aluminum). The initials are intended to be used freely throughout the industry in designating such products, as is the case with grade designation ACSR, Aluminum Conductor, Steel Reinforced. While testing continues, AAAC will be available in limited quantities through Kaiser Aluminum sales offices and distributors; redraw rod will later be available to other fabricators of electrical conductor.

FOR EQUAL CONDUCTIVITY

ACSR	ALLOY
Area = 6 Al + 1 steel	Area = 7 Al
Conductivity_{av} = 6 Al (61%) + 1 steel (0%)	Desired Conductivity_{av} = 52.3%
= 6/7 × 61% = 52.3%	Conductivity = 7/7 (52.3%)

FOR EQUAL STRENGTH

ACSR	ALLOY
Strength = 6 Al (25,000) + 1 steel (170,000) = (320,000 PSI)	Desired average strength = 45,700 PSI
av PSI/strand = 320,000 / 7 = 45,700	

TABLE I

Hence, from high-strength high-conductivity alloy with electrical conductivity of 52.3% and tensile strength of 46,000 PSI, a conductor can be designed that will be no larger in diameter than ACSR, which will have the same d-c resistance and strength as ACSR. It offers these advantages:

(1) Not difficult to splice—since only one splicing unit is necessary, which is standard practice with all aluminum or copper conductor.

(2) Not difficult to dead-end—since no separate clevis is necessary for the core and aluminum strands. The alloy conductor is stiffer than E.C. aluminum, but there is no extra stiff core wire to cause "basketing" when the conductor is bent to form around an insulated clevis or similar dead-end device.

(3) Quickly repaired—if a company is satisfied with past records of automatic splices or dead-ends on copper or aluminum, the alloy may be repaired in the same manner. Automatic dead-ends for ACSR require that both the steel and aluminum be separately gripped. This rules out the advantage of making electrical taps on the non-tension leg at dead-ends. With alloy conductor there is no need of separately gripping the aluminum and core wire.

(4) More favorable weight—since by equal volume steel is three times as heavy as aluminum and the core wire will now be alloy instead of steel. The alloy conductor will only weigh about 80% as much as the equivalent ACSR. (Consider the weight of 6 aluminum strands + 3 equivalent aluminum strands in the steel core wire replaced by 6 aluminum + 1 additional aluminum strand in the core. The total weight then is 7/9 that of ACSR, or approximately 80%.)

(5) Mono-metallic conductor—rather than two metals as in ACSR. The oxides of most aluminum alloys make the alloys self-protecting. Such is the case of the alloy considered here. In most areas where there is a corrosive atmosphere some method of core protection for ACSR can be used to protect the conductor—such as heavier galvanizing on the core wire or protection with petroleum compounds, but the fact still remains that steel and aluminum are far enough separated in the galvanic series that if the protective medium or the zinc separator is damaged, galvanic corrosion can occur and aluminum is the sacrificial metal.

This conductor has been named AAAC (all aluminum alloy conductor). It has a conductivity of 52 to 53% IACS and a tensile strength of 48,000 to 50,000 PSI depending upon the size of the wires used to fabricate the stranded conductor. This is a heat-treatable alloy drawn to desired size and heat treated to develop its electrical and physical properties.

Laboratory experimentation has advanced to the point where it becomes necessary to have field evaluation. It is a well known fact that laboratory aging and evaluation tests are good to a limited extent but cannot in all cases be correlated to field results. Such factors as corrosion, fatigue endurance limits, and notch sensitivity can be evaluated only by field service. The above factors are not primarily important in triplex service drops, for example, since there is little danger of the conductor being nicked or subjected to severe stress. The same is also true of weatherproof conductor. The tensions will be relatively low and the conductor will be protected from contaminants by a weatherproof covering. Field evaluation has begun on the alloy used as WP conductor or triplex neutral. Use of bare conductor is at present on an experimental basis only.

One example of field evaluation of interest, but which from laboratory examination could only be surmised, was noted during a recent installation in the East of bare 1/0 equivalent AAAC. Two of the three phase wires were pulled in over the cross arms using rollers and the conductor was kept off the ground by proper blocking over rocks, shrubs and tree stumps. The third phase was pulled in by dragging it over the cross arms and through brush and rocks. This third phase was examined and it was noted that there were few scratch or score marks such as are ordinarily found on E.C. when it is subjected to this mistreatment. It is noted that the Brinell hardness of the material is about 85. An average value for E.C. aluminum is about 45 and that of hard drawn copper about 95. This indicates that one of the common complaints about E.C., namely, the ease with which the conductor is scratched, will be minimized by the use of alloy conductor.

Another interesting fact is that this is a heat-treatable alloy. As such, when subjected to a current overload resulting in a high conductor temperature, the alloy will not suffer loss in strength to the same degree as does E.C. Strain hardened E.C. metal, once heated to a high temperature, suffers a loss of strength. This is cumulative. Each time the conductor is overheated it suffers an additional loss of strength. The heat treating temperature of this alloy is much higher than ordinarily encountered in service, and as a result, it suffers slight reduction in strength until the heat treating temperature is exceeded.

Notch sensitivity is a term that is ordinarily used to express the relation between stress concentration at a nick in the wire and the resulting wire failure. Since the material is harder, it is more resistant to notching. The factor of stress concentration, once a wire is notched, is not affected by the hardness of the alloy.

Another important property of an alloy is its endurance limit. It is a well known fact that endurance limit is dependent upon the maximum tension to which the conductor is subjected in repetitive cycles. The accepted limit for E.C. Conductor is 7000 to 8000 PSI for 500 million cycles. For this alloy, the endurance limit determined in the same way is 12,000 to 13,000 PSI.

Current Carrying Capacity

One useful formula for current carrying capacity is:

$$I = \sqrt{\frac{3.77 \times 10^4 (W_R + W_C) D}{R_{AC}}}$$

The terms W_R and W_C are respectively heat loss quantities due to radition and convection. They depend on pressure and temperature, but not on the basic metal involved. W_R also includes an emissivity factor which is more dependent on the surface condition of the conductor than the type of conductor metal.

Design of the alloy conductor is based on the d-c resistance of E.C. aluminum at 20°C. This is the same basis as used for ACSR conductor. On this basis, since the alloy has been shown to have the same composite conductivity of ACSR (approximately 52.3%), the diameters are, for all practical considerations, the same. For example, see Table II.

Since the diameter of ACSR and its equivalent AAAC are the same, the only factor which can vary the current carrying capacity of the conductor is the a-c resistance at the operating temperature.

The a-c resistance of conductor is dependent upon the d-c temperature coefficient of resistance, iron losses, and skin effect. In ACSR, all three factors are present while in AAAC the iron losses are absent. Therefore, the alloy has a lower a-c resistance than ACSR. Since current carrying capacity is in-

SIZE	STRANDING	OUTSIDE DIAM. IN.
No. 6—6/1 ACSR (TURKEY)	6/1 × 0.0661	0.198
No. 6 Equivalent Alloy (AKRON)	7 × 0.0657	0.197
No. 4/0—6/1 ACSR (PENGUIN)	6/1 × 0.1878	0.563
No. 4/0 Equivalent Alloy (ALLIANCE)	7 × 0.1884	0.565

TABLE II

Kaiser Aluminum

CONTINUED ON NEXT PAGE

versely proportional to the square root of the a-c resistance at the operating temperature, the current carrying capacity of alloy conductor is higher than that of ACSR.

* * *

During the electric industry's rapid expansion, Kaiser Aluminum has concentrated intensively on utility problems—with special emphasis on covered wire.

Today, Kaiser Aluminum is the nation's fastest growing producer of aluminum wire and cable, making available the latest helpful information on modern products and practices.

A Kaiser Aluminum representative or a KW distributor will be glad to give you immediate attention. Call your Kaiser Aluminum sales office. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

REPRINTS OF THIS ARTICLE AVAILABLE ON REQUEST

BARE AAAC (ALL ALUMINUM ALLOY)

Code Word	E.C. Equiv. Size	AREA		STRANDING			Strength Lbs.
		CM	Sq. In.	No.	Diameter, In. Strand	Diameter, In. Conductor	
Akron	6	30,210	0.0237	7	0.0657	0.197	1068
Athens	5	38,130	0.0299	7	0.0738	0.221	1348
Alton	4	48,110	0.0378	7	0.0829	0.249	1700
Austin	3	60,670	0.0477	7	0.0931	0.279	2144
Ames	2	76,440	0.0600	7	0.1045	0.314	2700
Astoria	1	96,480	0.0758	7	0.1174	0.352	3410
Azusa	1/0	121,400	0.0953	7	0.1317	0.395	4290
Anaheim	2/0	156,200	0.1227	7	0.1494	0.448	5301
Amherst	3/0	197,100	0.1548	7	0.1678	0.503	6687
Alliance	4/0	248,500	0.1952	7	0.1884	0.565	8430
COMPARATIVE DATA ON ACSR FOR EASY REFERENCE							
	Size	Aluminum Area					
Turkey	6	26,240	0.0206	6/1	0.1661	0.198	1170
Thrush	5	33,090	0.0260	6/1	0.0743	0.223	1460
Swan	4	41,740	0.0328	6/1	0.0834	0.250	1830
Swallow	3	52,620	0.0413	6/1	0.0937	0.281	2250
Sparrow	2	66,360	0.0521	6/1	0 1052	0.316	2790
Robin	1	83,690	0.0657	6/1	0.1182	0.355	3480
Raven	1/0	105,600	0.0829	6 1	0.1327	0.398	4280
Quail	2/0	133,100	0.1045	6/1	0 1490	0.447	5345
Pigeon	3/0	167,800	0.1318	6/1	0.1672	0.502	6675
Penguin	4/0	211,600	0.1662	6/1	0.1878	0.563	8420

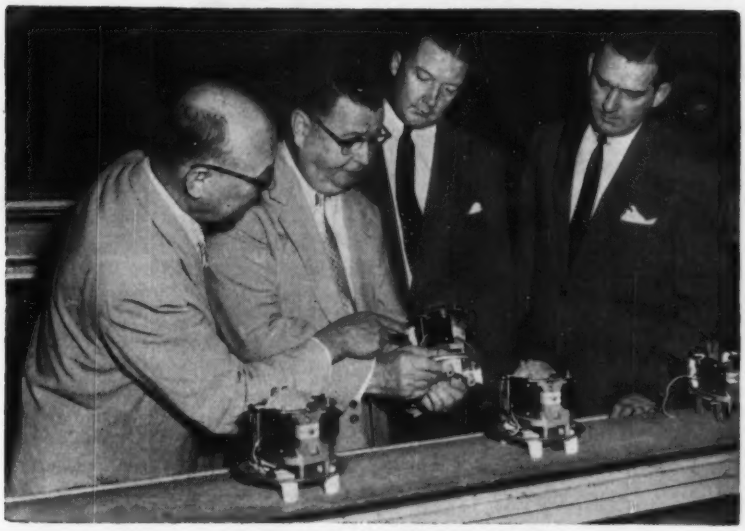
BARE AAAC (ALL ALUMINUM ALLOY)

Code Word	E.C. Equiv. Size	RESISTANCE ohms/1000 ft.		Inductive Reactance ohms/1000 ft. at one foot Spacing 60 CPS	WEIGHT—Lbs.	
		R_{DC} 20°C	R_{AC} 20°C		Per 1000 Ft.	Per Mile
Akron	6	0.6580	0.6580	0.1172	28.2	148.9
Athens	5	0.5218	0.5218	0.1145	35.6	188.0
Alton	4	0.4137	0.4137	0.1124	44.9	237.1
Austin	3	0.3281	0.3281	0.1097	56.7	299.4
Ames	2	0.2602	0.2602	0.1071	71.4	377.0
Astoria	1	0.2063	0.2063	0.1044	90.1	475.7
Azusa	1/0	0.1635	0.1635	0.1017	112.4	593.5
Anaheim	2/0	0.1297	0.1298	0.0988	145.9	770.4
Amherst	3/0	0.1029	0.1030	0.0962	184.1	972.0
Alliance	4/0	0.0816	0.0817	0.0935	232.1	1225.0
COMPARATIVE DATA ON ACSR FOR EASY REFERENCE						
Turkey	6	0.6580	0.6580	0.122	36.1	191
Thrush	5	0.5218	0.5218	0.119	45.5	240
Swan	4	0.4137	0.4137	0.116	57.4	303
Swallow	3	0.3281	0.3281	0.114	72.4	383
Sparrow	2	0.2602	0.2602	0.112	91.3	482
Robin	1	0.2063	0.2063	0.110	115.2	608
Raven	1/0	0.1635	0.1635	0.108	145.2	766
Quail	2/0	0.1297	0.130	0.105	183.1	966
Pigeon	3/0	0.1029	0.103	0.102	230.8	1219
Penguin	4/0	0.0816	0.0824	0.0992	291.1	1537

Kaiser Aluminum

IF IT CARRIES CURRENT, KW *CARRIES IT!*

LIVE BETTER ELECTRICALLY



Sangamo Introduces Network Meter

Sangamo's initial development in its new line of polyphase watthour meters is the Type P2S network meter. The socket type two-stator meter will have extended load range resulting from use of a slow full load speed of 8⅓ rpm.

Shown examining the first production run of the meter are (l-r) James H. Patton, vice president-manager, power equipment sales; Fred R. Kurz, assistant chief engineer; Robert R. Wylie, marketing manager; and Hugh W. Griffith, sales manager, watthour meters.

Okonite to Market Tape for Splicing, Terminating

Okoweld tape is a new product that will be marketed shortly by Okonite Co, Passaic, N. J. It is designed for splicing and terminating either plastic or rubber cables. Each thickness (30 mils) has a dielectric strength of 15,000 v.

The manufacturer recommends it for use as both insulation and sheath on cables operating under 2,000 v. This multi-purpose material is said to fuse into a solid unit without use of adhesives. It will be available in five colors for phase and circuit color-coding.

Turbo Furnace Sales Up

Orders for Turbo furnace boilers have now increased to 19, totaling 10,329,000 lb per hr steam capacity, reports Riley Stoker Corp, Worcester. A recent order is from Louisiana Power & Light Co for a 1.6 million lb per hr unit for its Sterling Electric Station. Turbo furnaces are now in operation at Tidewater Flying "A" Refinery operated by Delaware Power & Light Co. Three 500,000 lb per hr units, designed for fluid coke firing, are running there (EW, Feb. 18, 1957, p 18).

Allis-Chalmers Receives 340-Mw T-G Unit Order

Order for a 340-Mw steam turbine-generator has been received by Allis-Chalmers Mfg Co from Consolidated Edison of N. Y., Inc, for No. 4 unit in Astoria Station.

The 3,600/1,800 rpm cross-compound unit has steam conditions of 2,000 psig, 1,050F, 1,000F reheat, and 2-in. Hg exhaust pressure. With the 20-kv generators operating at 45 psig hydrogen pressure, they will have a capacity greater than 372 Mw divided approximately equally between the different speed shafts.

Excitation will be provided by separate motor-driven exciters for each generator. The high-speed shaft will have a provision for boiler feed pump drive.

L-M Makes Further Plans for Expansion of Plants

New projects in a continuing expansion program and completion of other important projects have been reported by President R. G. Wheaton of Line Material Industries, Milwaukee, Wis.

Among the projects he cited are:

- A new 53,000 sq ft warehouse at L-M's Central plant in South Milwaukee. To be erected at a cost of $450,000, the new building has been designed to provide roof-top parking for visitors and employees.
- Improved and enlarged production facilities, as well as a new 16,500-sq ft warehouse, at East Stroudsburg, Pa. Total expenditure planned is $395,000.
- Expansion and new construction, totalling $431,000, at Illinois Edison Porcelain Division in Macomb, Ill. A 230,000-sq ft building will provide enlarged production area. Construction of a new kiln is scheduled.
- Three new marketing facilities —within 90 days L-M will move into new sales offices and warehouses in Richmond, Va., Denver, Colo., Pittsburgh, Pa.

Additions previously announced were: new short-circuit testing laboratory in Franksville, Wis., on which construction is to start; transformer plant in Visalia, Calif., and Permaline product plants in Barton, Wis., and Sherman, Texas, on which work has been recently completed.

Mobile Exhibition Tours

Mobile exhibit from Fischer & Porter Co, Hatboro, Pa., manufacturer of industrial instrumentation systems, data reduction, and auto-

(*Continued on page* 86)

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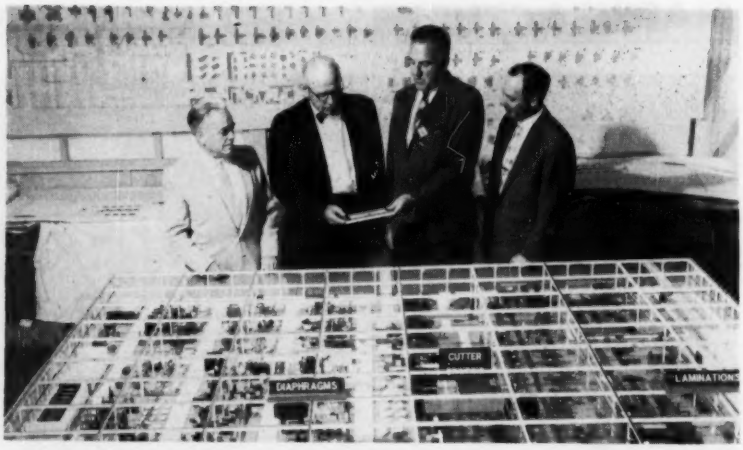


GE Plant Renovated and Retooled

More than 75% of the modernization and retooling on General Electric Co's Large Steam Turbine-Generator Dept, Schenectady, N. Y., has been completed. This progress report was presented to William E. Saupe, general manager, on his recent completion of 40 years with the company.

Shown looking at the 40-yr employment certificate, Saupe, second from left, is standing by a model of the renovated plant. In the new manufacturing area there will be provided enlarged facilities for steam turbine bucket and diaphram manufacturing, space for manufacture and assembly of surface coolers for steam turbine-generators, and production and processing area for generator stator laminations.

Presenting the certificate is William S. Ginn, vice president and general-manager—Turbine Division. Looking on are (left) Glenn B. Warren, vice president and consulting engineer—Turbine Division, and Clyde A. Lilly, Jr, manager-marketing, Large Steam Turbine—Generator Dept.

Mobile Exhibition

(*Continued from page* 85)

mation systems, is touring the country. It is housed in a stainless steel trailer, equipped to give demonstrations of F&P products before customer groups, technical schools and universities, and meetings of engineering societies. The tour is expected to be completed by June, 1958.

Large Fly Ash Collectors to be Installed for Con Ed

Two collectors reportedly largest designed for removal of fly ash are to be installed in the Astoria and Arthur Kill Stations of the Consolidated Edison Co of N. Y. These units will be supplied by Research-Cottrell, Inc, Bound Brook, N. J.

Essentially identical, with the exception of precipitator outlet flues to the stack, the equipment is expected to be in operation at the Astoria Station during 1958 and at the Arthur Kill Station during 1959, according to present schedules. Each fly ash collector will clean 1,400,000 cfm of flue gas at 300 F from a Babcock & Wilcox reheat boiler with a steam capacity of 2,500,000 lb per hr. Design efficiency of these combination mechanical-electrostatic precipitators is said to be higher than any similar fly ash collector previously ordered by Con Edison.

The boiler at each plant will have two collectors of four units each, each unit consisting of a mechanical collector followed by four sections of electrostatic precipitators in series. Each of these sections will consist of 28 ducts, each 20 ft high by 22 ft long. The precipitator will have top rapping of both collecting and discharge electrodes.

Air Compressor Saves Time in Ground Rod Driving

Combining a self-propelled air compressor, a Schramm Pneumatractor, with a stake driver and a pneumatic hammer enabled Utilities Line Construction Co, Jenkintown, Pa., to drive a 10-ft ground rod into the earth in 30 sec.

This combination of compressed air equipment greatly reduced the time and labor required to ground a 33-mile transmission line for Jersey Central Power & Light Co. A sledgehammer method would take a minimum of 15 min to drive a 10-ft ground rod into the earth.

More than 8,000 rod sections were used in this project. Grounding the 115-kva twin-circuit line necessitated inserting rods to various levels as the line ran through swampy terrain. To reach the depths needed for good ground reading ranges, 15 to 20 ohms, rods were driven to a maximum of 190 ft. Consistency of soil had a direct bearing on time to drive each rod.

York Corp To Supply Heat Pump for Sylvania

Below freezing air will have its heat extracted to warm the new research and development center of Sylvania Electric Products Inc, Amherst, N. Y. A York Corp compound compression air source heat pump will cool and heat the building.

Using the same equipment in summer for cooling the 90,000-sq ft, 2.5-story building, the system will be designed to heat the plant in winter without supplementary heaters. Located in an equipment room adjacent to the building, the heat pump has a capacity of 2.4 million Btu per hr. It is designed to keep inside temperature in winter at 70F with outside temperature ranging to —5F.

Summer design is for 78F with 50% RH when outside temperatures reach 93F. The system has a capacity of 250 tons of cooling to maintain these conditions. Control of changing between heating and cooling will be carried out by a Minneapolis-Honeywell supervisory data center and control system.

It's NEW!

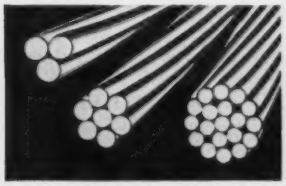
Wire that combines the strength of steel with the high corrosion resistance of aluminum

It's ACCO *Aluminized!*

PAGE STRAND

PAGE has successfully combined two time-tested metals into a revolutionary new wire—ACCO ALUMINIZED—that has a ductile, protective coating of aluminum *bonded* to iron and steel wire by a hot-dip method. This product is covered by and is manufactured under processes covered by U.S. and foreign patents.

Now PAGE offers ACCO ALUMINIZED Steel Strand for guy wire, ground wire and messenger wire applications. Can be used with Preformed Guy-Grip dead-ends made of ACCO ALUMINIZED Wire, or with galvanized pole hardware. Here is evidence of ACCO ALUMINIZED Steel Strand's superiority: salt spray tests conducted in strict accordance with ASTM procedures show that, for equal thickness of coating, aluminized *outlasts galvanized by more than 2 to 1.*



ALL STANDARD GRADES

PAGE ACCO ALUMINIZED Steel Strand is available in Common, Siemans-Martin, High Strength, Extra High Strength and Utility grades with physical properties meeting ASTM Spec. A-122-54-T and A-363-55-T.

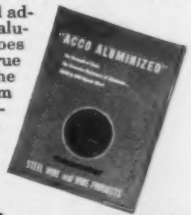
NOTE: We will continue to make and market PAGE Stainless Steel Strand and PAGE Galvanized Strand, as heretofore, in 3-, 7- and 19-wire construction.

Also... PAGE *Aluminized* ACSR CORE WIRE

Aluminum Conductor Cable with PAGE ACCO ALUMINIZED ACSR Core Wire is now available from many manufacturers of conductor cable. Product quality control is assured by a special testing procedure mutually developed by PAGE and ALCOA.

Send for Informative Booklet

How about ductility and adherence properties of aluminized wire? Why does aluminizing create a true duplex coating over the core? How does aluminum "sacrifice itself" to provide electrochemical protection? For answers, write us at Monessen, Pa., asking for **Booklet DH537-A.**



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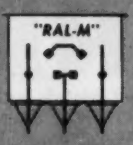
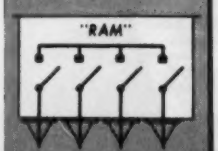
TYPE "RA" OIL SWITCHES ARE MADE IN VARIOUS FORMS TO MEET INDIVIDUAL REQUIREMENTS.





AVOID COSTLY SHUTDOWNS

in large industrial plants by providing cable system F-L-E-X-I-B-I-L-I-T-Y

with G&W Type "RA" *Load Break* OIL SWITCHES

Adequate flexibility has become very important in recent years as the use of underground cable systems has increased. While outages on cable systems are infrequent, the length of time on such outages may be long enough to cause considerable inconvenience.

With "RA" switches located at strategic points in cable circuits to provide flexibility, a system can be so arranged that important loads will have an alternate source of power immediately available.

Since their introduction in 1928, Type "RA" switches have had a trouble-free operating record which fully justifies their use as load break disconnects for single or multiple circuits. They are safe and reliable, combining simplicity with economy in construction, installation, and maintenance. They will operate properly after long periods of inactivity to provide fast and convenient isolation of cable sections in case of trouble and to permit rapid rerouting of circuits to materially reduce losses normally incurred through electric service interruptions. Exposure to weather extremes or complete submersion for prolonged periods will not affect prompt and safe operation when necessary. They are water-, oil-, and air-tight.

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ELECTRICAL BUSINESS OUTLOOK

Electrical World

JULY 29, 1957

The outlook for 1958 is good for the electric utility industry. Electrical World's market research section, busily preparing for the September 2 Forecast Issue, has prepared a preliminary analysis to answer major questions on the near-term outlook. Some highlights:

Residential consumption will be the driving force behind next year's sales. Average annual residential usage will be 3,444 kwhr adding up to 164-billion kwhr of home sales. This will be an 11% gain over 1957 figures which are expected to hit an average of 3,183 kwhr per customer for total sales of 147 billion kwhr.

Industrial sales in 1958 should score a 4½% gain over anticipated energy sales of 292-billion kwhr this year. The present plateau in industrial production will be followed by an upturn this fall, EW forecasts. And the production pickup will produce a year-end gain of 6% over 1956 industry sales.

Commercial sales will hit 104-billion kwhr in 1958 compared with 95-billion kwhr expected for all of 1957. Commercial customers' usage this year will top last year some 8%.

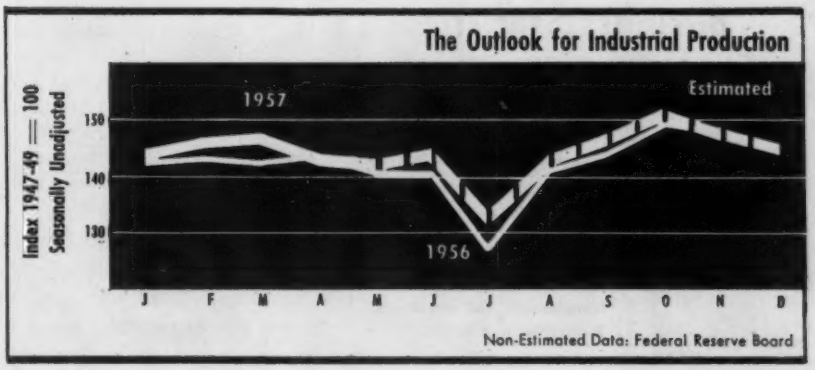
• • •

No change between July 4 and Labor Day. That's been a general rule of thumb in business forecasting, and this summer seems to fit the pattern.

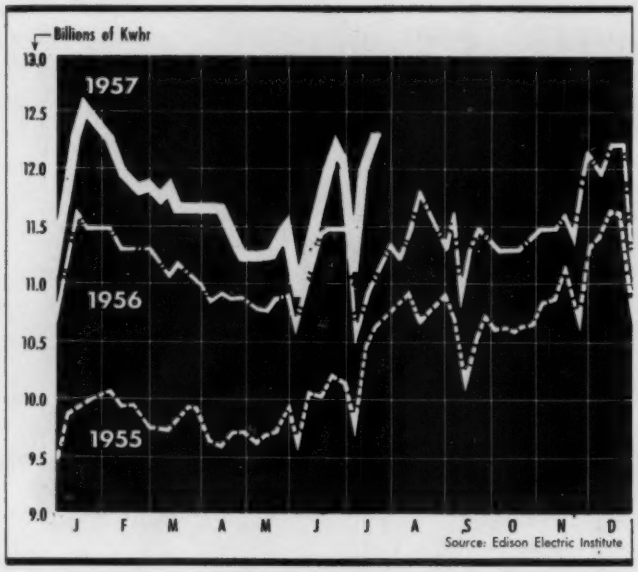
While employment figures jumped 1.4 million last month, the gain was nothing more than the seasonal pick-up in summer jobs. Industrial production hasn't changed for three months. And (despite the complaints) even the price hike in steel was pretty much in line with expectations—even a little less.

Defense spending is the one thing which may have taken a new twist. The 100,000-man cutback in armed forces will have much more bite than all the fuss about the budget.

Excess capacity is another trend which may become more significant as the year wears on. Manufacturing is now turning out about 81% of potential output, which is a good bit more than the usual 10% kept idle. This factor has already had a bearing on long-range plans for new plant and equipment. In 1957, plans called for 52% of capital spending to be for expansion and 48% for modernization. But in plans for 1958-1960, the percentages are almost exactly reversed—with modernization taking 53% of the total. If past trends are a guide, the shift means a less hectic pace for the overall level of capital investment.



STATISTICS



OUTPUT

Week ended July 20,
12,306,000,000 Kwhr
Up 10.6%

Per Cent Change From Previous Year

	July 6	July 13	July 20
Total U. S.	+ 6.4	+10.0	+10.6
New Eng.	+ 0.7	+ 2.3	+ 7.4
Mid. Atlan.	+ 1.8	+ 6.2	+ 8.9
Cent. Ind.	+ 4.8	+11.9	+12.4
West Cent.	+ 7.8	+18.6	+23.9
Southeast	+ 6.2	+ 7.7	+ 6.1
South Cent.	+11.1	+14.5	+14.3
Rocky Mount.	+ 7.7	+ 6.4	+ 8.0
Pacific			
NW	+ 8.7	+ 7.0	+ 9.1
SW	+13.5	+13.0	+10.2

Seasonally Adjusted Index 233.7
Week Ago 231.4
Year Ago 210.7

Atomic Energy Commission requirements—1,135,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 11.7%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	May	122.79	122.27	117.43	4.6
Peak—Class 1 Systems. million kw	April	97.7	98.0	91.6	6.7
Estimated Dec. '57 Peak	April	113.6	113.5	114.1	− 0.4
Production—billion kwhr	May	51.70	50.67	49.09	5.3
Hydro		11.80	12.05	11.71	0.8
Fuel		39.90	38.62	37.38	6.7
Sales—billion kwhr	April	47.15	47.75	44.58	5.8
Residential		12.72	13.47	11.86	7.3
Commercial		7.25	7.35	6.71	8.0
Industrial		24.66	24.44	23.60	4.5
Other		2.52	2.49	2.41	4.6
Fuel Consumption	May				
Coal—million tons		12.60	12.50	12.05	4.6
Oil—million barrels		6.31	6.47	4.47	41.2
Gas—billion cu ft		108.66	98.80	110.51	− 1.7
Net Income Class A & B Co's—$ million	May	101.75	115.93	102.50	− 0.7
Residential Customers—millions	12 mos.	46.06	45.99	44.76	2.9
Revenue per kwhr	ended	2.58¢	2.59¢	2.62¢	− 1.5
Avg kwhr per customer	April 30	3,034	3,021	2,838	6.9
Avg annual bill		$78.28	$78.24	$74.36	5.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	June	143	143	141	1.4
ENR Construction Cost	July	151.8	151.2	145.6	4.3
BLS Cost-of-living	May	119.6	119.3	115.4	3.6
New Orders for Machinery (1950 = 100)	May	148	145	157	− 5.7
NEMA Sales					
Insulation materials	May	148	145	158	− 6.3
Electric appliances		88	83	103	−14.6
Wholesale prices	May				
Motors and generators		141.3	141.4	137.5	2.8
Transformers and regulators		147.7	147.4	137.5	7.4
Switchgear and fuses		165.9	164.4	151.2	9.7
GNP—annual rate—$ billion	2nd Qtr.	433.5	429.1	410.8	5.5

MANAGEMENT BULLETIN

FINANCE

All eyes in the financial community are now focused on what the Federal Reserve Board will do with the rediscount rate. After the announcement of the Treasury to refinance $24 billion worth of maturing government securities at rates ranging from 3⅝ to 4%, bankers feel that the rediscount rate could very well go to 3½% as compared with 3% now. These two moves could force electric utilities to pay more for their money to take care of their record-breaking construction programs.

Two recent debt issues of electric utilities did not sell too well. As soon as the underwriting agreements terminated, Jersey Central Power & Light Co bonds with an "A" rating which were sold to the public at 101.563% to yield 4.90% were sold down to 98½% to yield 5.10%. Central Illinois Light Co bonds ("Aa rating) which were priced at 100.80% to the public to yield 4.575% were quoted at 97½% to yield 4.79%. This is a difference of 22 basis points.

With a possibility of higher interest rates, new offerings of electric company securities will be hitting their usual summer vacation slump. Financing schedule of the Irving Trust Co shows that only $40 million of debt and $6 million of preferred stock will be offered to the public. This is the lightest month since April of this year when a total of $55 million was offered.

Institutional buyers are taking a close look at utility common stocks these days. So reports Ted Locke, utility analyst for Goodbody & Co, 115 Broadway, New York 6, in a special study.

Reason says Locke: "Until the sharp rise in money rates in recent months, institutional investors such as pension funds, trust departments, insurance portfolios, etc, generally bought good utility stocks for income, since the yield on these stocks was generally better than the yield on bonds, and tended to grow in earnings and dividends which was a factor in their selection but fast growth as such was not the impelling factor. Yield and gradual growth were the reasons for buying utility stocks."

This philosophy has changed for these buyers. They are insisting on fast growth per share or a high yield because they can get such good yields in bonds. This is why, Locke points out, that a small group of "fast growth" utility stocks has been in such a strong demand.

What should holders of utility stocks do now?, asks Locke. Retain their present holding, he advises. No need to dump the stocks now. Utilities are not facing any important drop in earnings. At worst, he says, some companies may find their stock has less of an institutional following than it had, and has sold down to some extent in market price for this reason.

However, this change in emphasis means that some managements must endeavor to get rate increases to offset higher costs and must follow financial policies that will lead to an increase in per share earnings if their stock is to do well marketwise.

ACQUISITIONS

Utilities continue to acquire properties. Indiana & Michigan Electric Co has purchased all facilities of the Kendallville, Ind., municipal electric utility except land and buildings, for $1,181,500. Kendallville voters favored the sale of the properties in a special referendum on May 21, and the transfer was subsequently approved by the Indiana Public Service Commission . . . Board of Control at St. Bernard, O, has approved the proposed sale of the city's 62-year old power plant to Cincinnati Gas & Electric Co for $715,000 . . . Northern States Power Co is negotiating for the purchase of Wisconsin Hydro Electric Co . . . Central Power & Light Co is eyeing the municipal electric system at Brownsville, Tex.

MANAGEMENT BULLETIN continued

REGULATION

West Virginia Public Service Commission's rate-making powers and "the broad subject of public utilities" should be investigated. So proposed Sen. A. Carl Carey, Kanawha County Democrat, who asserted that the "seemingly never-ending number of petitions by certain public utility companies" to the PSC for higher rates "appears to me to be an appropriate subject for legislative study and action."

EMPLOYEE RELATIONS

Supervisors are invited to a three one-week unit course by the American Management Association. It will be held at the Savoy-Plaza, New York City, on Sept. 9-13; Sept. 16-20, and Oct. 21-25. It will be repeated at the Penn Sherwood Hotel in Philadelphia, Oct. 7-11; Oct. 14-18, and Nov. 11-15, and again Jan. 13-17; Jan. 20-24, and Feb. 24-28. Fee is $600 for the three week course, covering course material, tuition, and luncheons.

First week of the course will cover the job of the first-line supervisor. Basic principles of management, fundamental rules of supervision, and a formula for managing the supervisory job will be outlined.

Second week will deal with supervisory skills and tools. Specific topics to be discussed include production planning and control, maintenance, wage and salary administration, safety, training, and discipline.

In the third week, scheduled to be taken a month after completion of the other two units, the emphasis will be on human relations. Workshop sessions will give the participant a chance to integrate experience and theory and to improve his ability to get results through people. For further details, write AMA, 1515 Broadway, New York 36.

RIGHT-OF-WAY

Utility wins hard-fought case. Superior Court of Pennsylvania (Case No. 204) W. W. Laird vs Pennsylvania Public Utility Commission affirmed a PUC order granting the Philadelphia Electric Co approval of the exercise of eminent domain so that the company could construct a 220-kv line on steel towers, crossing 847 ft of Laird's farm.

The necessity of the line, the court pointed out, had already been established as the area to be served included oil refineries, ship building, steel production, and other industries vital to the nation's peace-time economy and national defense.

Court said: "The location finally decided upon, and the manner of construction, were dictated by considerations which, in the commission's judgment, management had justifiably found controlling . . . We find no abuse of discretion, error of law, or lack of evidence to support the finding, determination, and order of the commission."

PUBLIC RELATIONS

"Today" an employee magazine of Pennsylvania Electric Co has suspended publication. Reason: Recent reader survey to which only 4.3% of all employees replied. This, along with the lack of interest shown in personal interviews, indicates that the publication of "Today" should be discontinued. However, consideration is now being given to a new publication.

Employees of two utilities form choral group of 70 voices. They rehearse in split sessions. New Jersey Power & Light Co group meets on Tuesday evening while the Jersey Central Power & Light Co comes together on Wednesday evening. The two groups will hold joint rehearsals in the fall for its first public appearance which will be before the New Jersey Public Utilities Association on Nov. 7 in Absecon. Pres Charles E. Kohlhepp, president of both companies, sings bass in the chorus.

NOW! A COMPLETE PRACTICAL SPLICING PACKAGE

T&B SHURE splicing means a wide range of connector sizes and types filled with T&B joint compound—vacuum packed in vinyl—installed by the pocket size SHURE Squeezer® for easy, fast, sure service entrance and distribution wiring

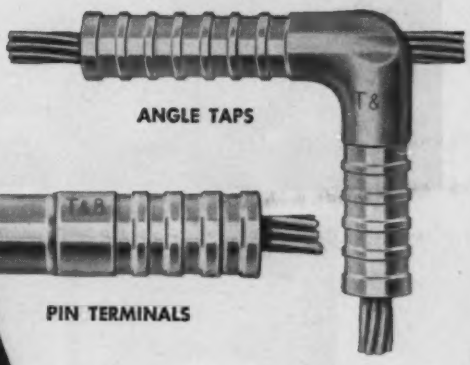
Ask for information on the complete T&B Method line; quality compression connectors for every conductor size and type, *with* the right tools to install them.

ACTUAL SIZE

Splicers are mounted on perforated cards with installing instructions on back. Tear off only what you need.

SHURE feature makes it impossible to remove tool without taking the full bite... assures perfect compression every time.

Patents Pending



ANGLE TAPS

PIN TERMINALS

T&B ENGINEERED

THE THOMAS & BETTS CO.
INCORPORATED
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898
14 BUTLER STREET • ELIZABETH 1, N. J.
THOMAS & BETTS LTD., Montreal, P.Q., Canada

Please send me your UT5 Bulletin on service and distribution connectors and the NEW UT2.

NAME_____
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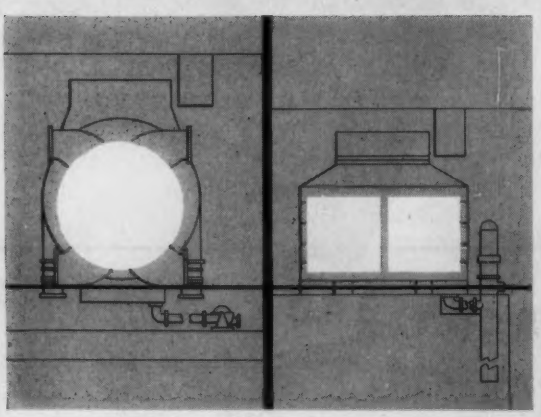
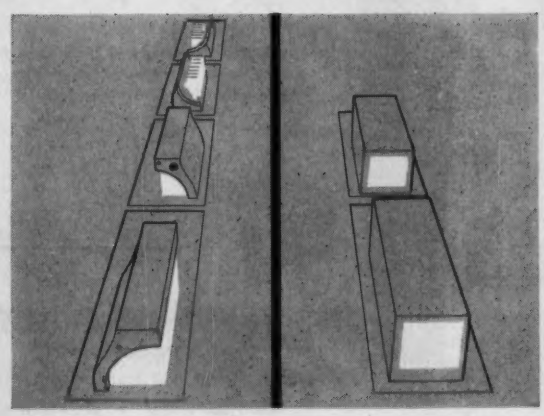
WESTINGHOUSE RECTANGULAR



Waste no space! Rectangular condensers require less headroom, fully utilize all space under turbine.



Faster installation! Rectangular condensers can be shipped in "bigger chunks" . . . less field welding.

CONDENSERS ...another great timesaver for station erection schedules

SAVE TIME—Basic simplicity of rectangular condenser design makes it possible to ship "bigger chunks of capacity." Building-block assembly speeds rigging; field welding is drastically cut. With its flat base, it is quickly and easily leveled. Westinghouse rectangular condensers can get you on the line faster.

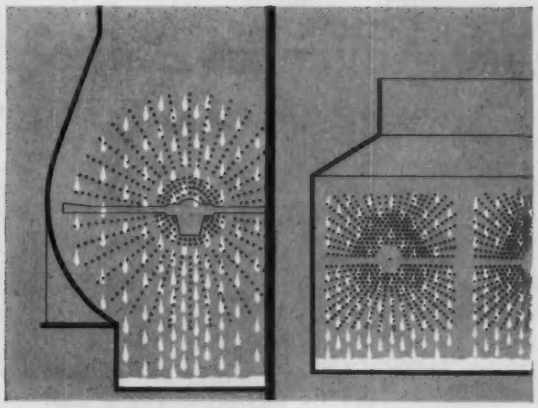
SAVE SPACE—As station ratings go higher and higher, equipment gets bigger. That's when space utilization takes on increasing importance. Westinghouse rectangular condenser design uses *all* the space under the turbine—*wastes none.*

BOOST EFFICIENCY—Two things, above all, you want from a condenser: Lowest possible absolute pressure, maximum reheating and deaeration of condensate. With its two-compartment radial-flow design and consequent short steam path to center air offtakes, a rectangular condenser provides lowest pressure drop. Uniform fall of condensate and the counterflow of steam from the lower steam belt liberate oxygen and assure deaerated condensate at saturation temperature.

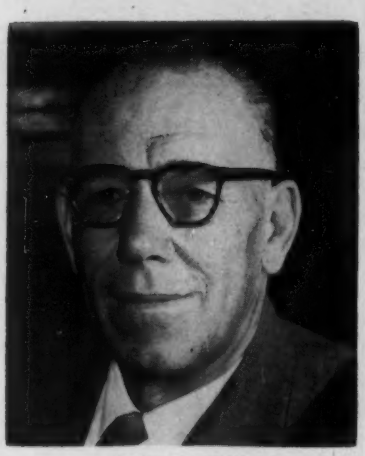
Get the full story on Westinghouse condensers, circulating pumps, condensate pumps and air ejectors from your Westinghouse representative; or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50595

YOU CAN BE SURE...IF IT'S

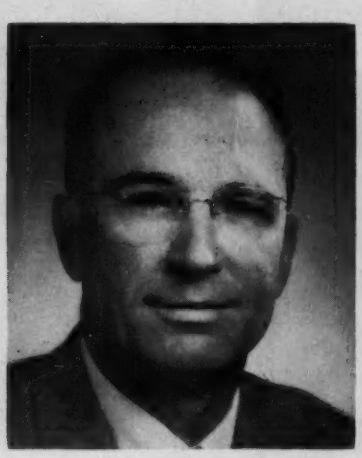
Westinghouse



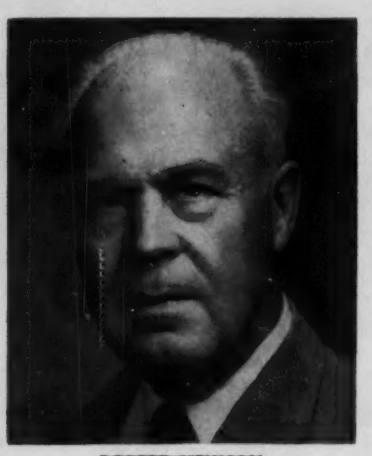
Boost efficiency! Lowest pressure with maximum reheat; condensate falls uniformly through belt of steam.



CARL C. ERNST



FRED OLDENDORF



ROBERT NEUMAN

Calectric Elects New President and Two VP's

California Electric Power Co has announced the election of Carl C. Ernst as new president of the utility. He was named to succeed Albert Cage, who has retired as president after 11 years service in that post.

In addition, Fred Oldendorf was named vice president and general manager and Robert Neuman rose to the newly created position of vice president in charge of districts.

Ernst, who has been vice president and general manager since 1946, began his employment at Calectric 37 years ago. After attending the University of California's school of engineering, he joined the utility in 1920 as an electrician and lineman. From there he was promoted to local agent in 1921, Perris local superintendent in 1922, Corona local superintendent in 1923, and superintendent in Calexico in 1927. He was later advanced to assistant district manager in El Centro and then to district manager at Tonopah, Nevada. His 1944 appointment as vice president and executive assistant was followed the next year by his promotion to vice president and assistant general manager.

Oldendorf, who was named to fill the vacancy created by Ernst's promotion, has been vice president and assistant general manager since 1951. His association with Calectric began 28 years ago when he was employed as a clerk in the operating department. Then, after a short time in the company's student training program, he was named to positions of increasing responsibility—engineering clerk, rate clerk, commercial engineer and budget supervisor. In 1944 he was appointed assistant to the president and was elevated to the position of vice president and assistant to the president in 1946.

Neuman, a 38-year Calectric veteran, has served as superintendent and district manager in San Bernardino since 1923. His first position with the company was as senior student in 1919. He has also served as local superintendent in Corona.

Kyova Names VP

Jack M. Dollenmaier has been elected by Kyova Fiber Pipe Co as its vice president in charge of marketing and sales.

Before joining Kyova in this capacity Dollenmaier held sales administrative positions with electrical manufacturers in Michigan and New York. He had previous experience in the electric and gas utility industry in Illinois.

J. M. DOLLENMAIER

Chase Advances Barno

Peter S. Barno has assumed his new duties as vice president of public and industrial relations and member of the board of directors of Chase Brass & Copper Co, Inc, a subsidiary of Kennecott Copper Corp. He replaces Rodney Chase, who retired recently.

Barno was formerly with Studebaker-Packard Corp as the director of industrial relations.

P. S. BARNO

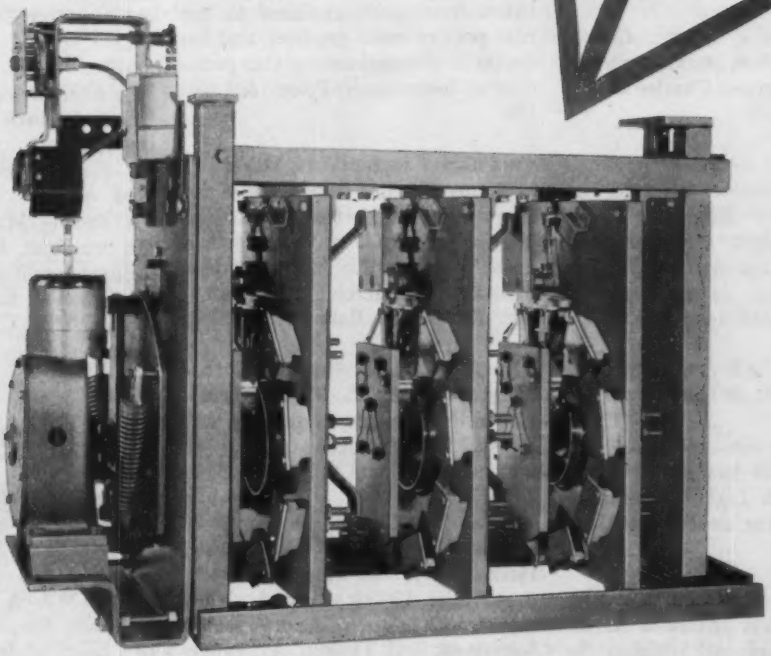
reasons for remarkable service of ALLIS-CHALMERS 3-phase regulators

Simplicity of design is an important reason why the tap-changing mechanism of Allis-Chalmers regulators gives long, truly trouble-free service.

- All moving parts, including driving motor, are completely immersed in oil — nothing to lubricate or adjust.
- Countless gears and cams eliminated to reduce moving parts to a minimum.
- Simple, capacitor-type motor has no commutator, slip rings, brushes or centrifugal switch — can withstand stalled current without damage.
- Taps changed with fast snap action — without shock — without brakes or sealing-in switches.

These are just a few of the many reasons for the outstanding service record of Allis-Chalmers 3-phase regulators. For complete details, call your local A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

simple mechanism



ALLIS-CHALMERS

A-5462

Probst is Operations VP at Brown

T. R. PROBST

Brown Co has named T. Richard Probst to the position of vice president in charge of operations, effective August 1. His responsibilities include direction of personnel matters.

An engineering graduate of Pennsylvania State College, Probst has been vice president-manager of mills of Eastern Corp since 1954.

Robert W. Andrews, vice president, will now direct general engineering and capital projects at the New Hampshire and other plants.

PERSONAL BRIEFS

At Montana-Dakota Utilities Co, the treasury department has named **B. H. Thompson** general auditor in charge of the new audit division and **Lowell Gamble** director of the new rate research, tax, and insurance division . . . **Bruce Harris** has advanced to superintendent of the power plant now being built at Sidney, Mont., and **Clark C. Gillespie** has assumed new duties as chief engineer of the firm's Mobridge plant.

Robert S. McAfee has been named manager of the Sherman district of Texas Power & Light Co to succeed **J. H. Durning,** retired.

San Diego Gas & Electric Co recently named **Jack A. Graham** assistant secretary and **Charles Davies** assistant treasurer.

Numa F. Vidal has been appointed Lake Erie Division manager of Ohio Edison Co. Replacing him is **Robert A. Knight,** who has been named to manage the new Mercer County Division of Pennsylvania Power Co, a subsidiary.

Col Robert C. Alley will retire as purchasing agent of Gulf Power Co on July 31.

Stewart G. Neel has joined Puget Sound Power & Light Co to manage the new area development department.

Pacific Power & Light Co's **R. Victor Bauer** has advanced to industrial development engineer in the Wyoming service area . . . **James B. Ward** has joined PP&L's engineering staff as research engineer. His duties will include programming of engineering applications for the new electronic computer system.

At Georgia Power Co, **Neil A. Gleason** is new Valdosta Division industrial sales engineer; **Eugene A. Yates, Jr,** and **Joe B. Browder** are assistants to the sales vice president; and **Lamar T. Wansley** has advanced to manager of the rural division.

George F. Switzer has been elevated from chief engineer to the new post of chief engineer and assistant to the engineering vice president of Indianapolis Power & Light Co.

Carl Yancy replaces the late **T. E. Williams** as chief dispatcher in the transmission department of West Texas Utilities Co . . . Connecticut Light & Power Co has as its new assistant commercial sales manager **Richard E. Ballard.**

Tennessee Valley Authority has named **Clarence E. Blee** to its engineering consulting board. He was TVA chief engineer from 1943 until his retirement this year.

Tacoma City Council has approved the appointments of **John Rue, Harry Berry,** and **James Healy** to the Public Utilities Board. They replace **Gerrit V. Ende, Ralph Johnstone,** and **Thomas A. Anderson,** who have left the board through resignation or retirement. **Harold R. Johnson** is new chairman, **Edward Hudson** is vice chairman, and **Rue,** secretary.

John M. S. Griffen has been promoted to division engineer of Jersey Central Power & Light Co's Bay Division . . . The division has named **John M. Upperman** utility construction-maintenance supervisor.

Georgia Institute of Technology has as its new president **Dr Edwin Davies Harrison,** former dean of engineering at University of Toledo . . . **Dr Ernst Weber** has been named acting president of Polytechnic Institute of Brooklyn to succeed the late **Harry S. Rogers.**

Virginia Electric & Power Co recently advanced **Marvin J. Hornsby** supervisor of the customer accounting operation at Richmond and made **Elmer B. Hurst** assistant director of personnel.

Francis V. du Pont has been appointed to a six-year term on the Maryland Public Service Commission . . . New chairman of Michigan's PSC is **Otis M. Smith,** whose term expires in July of 1961.

Pennsylvania Electric Co's **Harry B. London, Jr,** has been designated operating superintendent of the Northern Division.

Quebec Hydro-Electric Commission's Industrial department has elevated **Roch E. Gohier** to industrial department director.

New officers of American Society for Testing Materials for 1957-58 are president, **Richard T. Kropf** of Belding Heminway Co, Inc; and vice president, **F. L. LaQue** of International Nickel Co, Inc.

OBITUARY

Jacob H. Goetz, 71, former chief counsel for Consolidated Edison Co of New York, Inc, died recently.

George Wilson, 58, president of the Colorado Rural Electric Assn, died of a heart ailment in Denver.

"An almost indispensable tool," said the Vice President . . .

"Invaluable for setting quotas," said the Sales Manager . . .

"A constantly used reference," said the Librarian . . .

Whether you're a key man in the utility's main office, or a sales specialist for a manufacturer, the McGraw-Hill Directory of Electric Utilities is your basic reference book on the industry. It will tell you the company officials and service areas coast to coast with equal facility–and at trifling cost. Here in one place you'll find the basic business information on every electric utility in the U. S. and Canada–town and population, company, street address, operating officials, generating capacity, prime mover and type of service, distribution voltage and pole mileage, total customers, towns served, plant locations–all essential data on every operating electric utility, whether private, municipal, or cooperative. Beautifully bound in dark green and silver, the Directory includes over 30,000 changes in names, titles, and operating information which have taken place in the industry in the last twelve months.

For up-dating your mailing list, insuring accuracy of names and titles, providing current bench marks for your selling operation, there is no substitute for the McGraw-Hill Directory of Electric Utilities, at any price. New 1957 edition just out and going fast–order your copy now, using the handy coupon below.

What Do You Say?

DETAILS AND PRICES

FOR BRANCH OFFICES—or companies interested only in limited areas—the same data is available by states at nominal prices. However, state sections will be supplied only to those firms ordering a minimum of one complete 1957 directory. These are the prices . . .

AT $3.00 EACH . . . Arizona, Delaware, D. C., Idaho, Montana, Nevada, New Hampshire, New Mexico, North Dakota, Rhode Island, Wyoming.

$4.00 EACH FOR . . . Alabama, Arkansas, Colorado, Connecticut, Florida, Georgia, Kansas, Kentucky, Louisiana, Maine, Maryland, Mississippi, Missouri, Nebraska, New Jersey, North Carolina, Oklahoma, Oregon, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia.

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I say "yes!" Please reserve ——— copies of the 1957 McGraw-Hill Directory of Electric Utilities at $40 each, 10% discount on 5 or more copies. Invoice me after shipment has been made.

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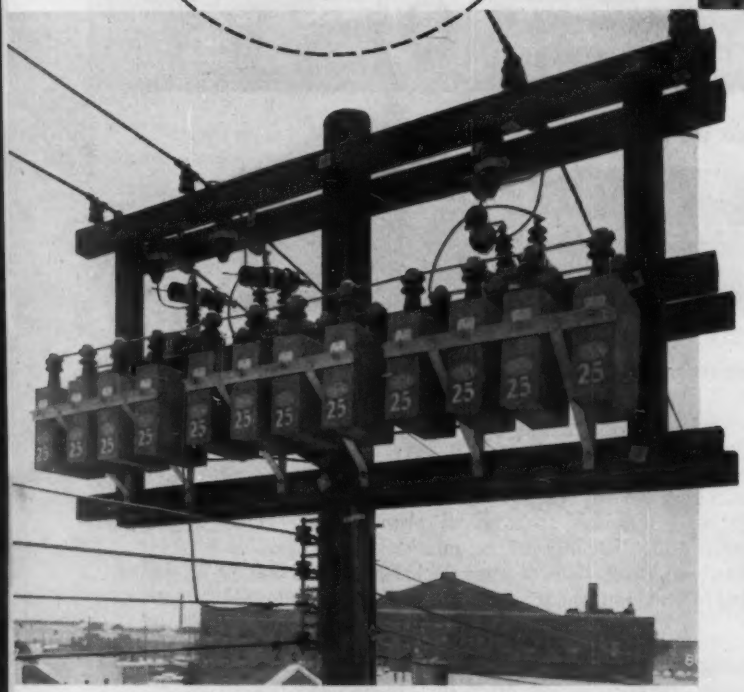
Sangamo
Capacitors
"APPROVED"
by more and more
major utilities!

Dielectric packs are wound of special kraft paper and pure aluminum foil. Atmospheric conditions are controlled to eliminate any danger of contamination.



Constant care in longer service

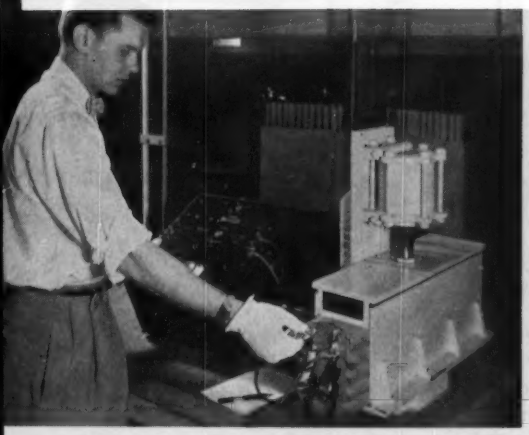
Sangamo Power Capacitors are built to rigid specifications to meet power engineers' requirements for stable performance and long service life.

Rigid quality control of raw materials . . . constant care in every step of manufacturing . . . thorough testing and inspection . . . are all part of these specifications.

These capacitors are built in one of the country's most modern "controlled conditions" manufacturing plants. Dust is filtered out of the atmosphere to eliminate danger of contamination. Temperature and humidity are controlled to assure product uniformity.

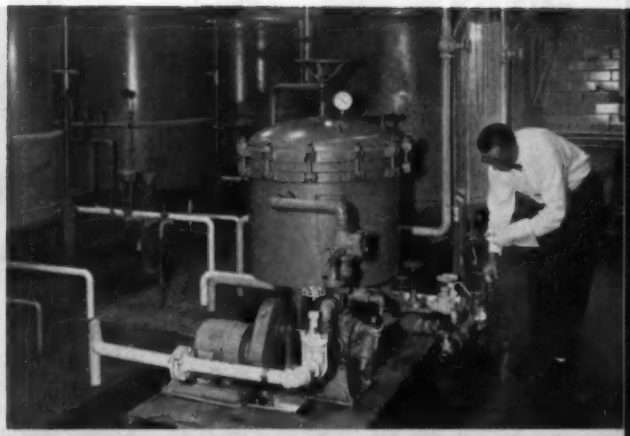
The power engineers of many major utilities have inspected Sangamo's processing facilities, some of which are shown on these pages, and

This bank of 25 Kvar Sangamo Capacitors is controlled by the voltage type Sangamo VC Lincolntrol shown below. The service is 2400/4160 Y grounded neutral with capacitor cases and Lincolntrol tied in with ground.



Specific tests precede and follow almost every processing operation. Here dry rolls are being measured for capacitance and power factor.

Sangamo Diaclor, the liquid dielectric used in these capacitors, is purified here. Great care is taken to maintain its purity.

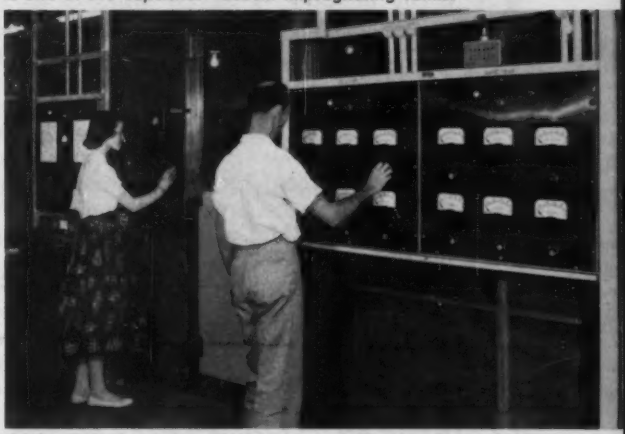


Sangamo's facilities are geared for quantity production. Here is one of the capacitor vacuum impregnating tanks.

production means on your lines

have put Sangamo Capacitors on the "Approved List" of their respective companies. Sangamo Power Capacitors are available in 15, 25 and 50 Kvar units, in all primary voltage ratings, and in factory-assembled and wired Auto Var equipments for pole-type installation.

Sangamo also manufactures Lincolntrols and Time Switches for automatic capacitor control as a function of time, volts, amperes, watts, or vars—or as combinations of these functions. Look to Sangamo for all your capacitor requirements ... visit our plants ... inspect our facilities. Ask your Sangamo Representative, or write us for complete information.



Each unit is tested for overvoltage, capacitance, power factor, and radio noise in a completely shielded test booth. Capacitance and power factor measurements are made at rated voltage and frequency with a high-precision bridge.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

After final inspection and tests, the completed capacitors come off the assembly lines and are packaged for shipment to you.

AIEE Editorial Brings a Reader's Criticism

To the Editor:

I have just read the worrisome editorial in the July 1 issue. Hasten to assure you that as a representative associate member of AIEE and a member of NSPE, it is my opinion that the engineering profession has far more to fear from a "let's be careful—wait and see" attitude as expressed in this editorial than from a dynamic, constructive step toward unity as outlined by M. S. Coover.

It is refreshing and encouraging to see some real signs of leadership and specific recommendations in this direction emerging from the AIEE board of directors, and may the new board have the courage to continue the drive.

I regret to see that the editorial derives its arguments from manipulation of the language. For instance, you express concern that ". . . the AIEE Board has said that AIEE, an organization with 50,000 members, should turn over a major responsibility to NSPE, a smaller one . . ." True, NSPE is a smaller one, but not so much smaller—and growing at a faster rate than AIEE. The membership of NSPE is 42,000 —84% as large as an institute 50 years older, that has always concentrated on the technical aspects of the profession.

Also, you imply that Mr Coover's policy statement regarding AIEE concentration on technical matters is new. It is not. He quotes a policy statement issued on June 15, 1950 —7 years ago. As you will recall, it was announced that the Institute's policy would be—(paraphrased)

1. To work toward unity of the profession.
2. To recognize that the technical field was the Institute's chief reason for being.
3. To handle non-technical affairs on an emergency basis only.

You also imply that the AIEE board has just recently recommended that members take steps to become registered. Again, not so. Mr Coover says: "AIEE has for many years recommended to its members that they should take steps to register as professional engineers."

You say: ". . . only a minority of AIEE members are affiliated (with NSPE) or meet membership qualifications by registration." Not so. AIEE headquarters informs me that as of 1955, 42% of their members were registered with another 9% engineers-in-training—a total "of 51% and certainly more than only a minority." If we consider only Member and Fellow grades, the percentage registered is much higher—perhaps 80%.

As you know, the engineering profession has been wishing for and talking about unity for lo these many years. And the fact that we have to talk so long with so little action is evidence enough of the need for a strong unified organization that can speak for a majority of the profession.

Now that one of the oldest and largest technical societies has taken concrete steps to foster such an organization instead of resisting and competing with it, national publications such as yours with their well-qualified staffs and wide professional readership should get on the "unity bandwagon" and join the parade instead of dragging their feet and shouting "Take it easy!"

I think that NSPE's rigid requirement for registration has been a deterrent, but you must admit that it provides one of the soundest and best recognized, legal, bases for membership. I think an "associate" grade of member—without full privileges, perhaps—to include the fringe class of engineers would be a step in the right direction.

Thanks for listening and may we always enjoy the privilege of expressing our opinions.

Henry E. Crabtree
6 Weston Road
Marblehead, Mass.

Index Available

The index for Vol. 147, January through June 1957, is now available to subscribers. Extra copies are free on request to: Information Service, Electrical World, 330 West 42nd Street, New York 36, N. Y.

Acceptance of Meter Standards Too Slow

To the Editor:

Congratulations on your editorial in the May 20 issue on "Meter Standards Need Wider Acceptance."

We are in hearty agreement with this editorial and the need for greater acceptance and use of standards. Unfortunately, the progress which you have reported in this editorial toward the acceptance of standards in the meter industry, particularly with respect to single-phase meters, is a little rosy. It is true that a greater portion of the industry is using socket type meters in the 240-v, 3-wire capacity, but our production of a single type is being diluted rather than increased. In 1952, the variation of the socket type 15 amp, 240 v, 3-wire meter which accounted for more sales than any other item of single-phase meters, amounted to 56% of single-phase unit sales. The most popular similar meter in 1956 only accounted for 48% of single-phase unit sales.

In 1952, the 15 amp, 3-wire meter accounted for 76% of our shipments, while in 1956 it accounted for 86% of shipments. But, in this one 15 amp, 3-wire category, there were eight different variations of this basic 15 amp, 3-wire meter.

We, as manufacturers, with constantly increasing stocks due to these variations are faced with continuing problems. This dispersion of types, for equipment which will provide the same basic measurement, is uneconomical for the manufacturer and the users as well.

James H. Patton
Sangamo Electric Co
Springfield, Ill.

MEETINGS CALENDAR

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

Electric Companies Advertising Program—Copy Group Meeting, Seaview Country Club, Absecon, N. J., Aug. 22.

American Institute of Electrical Engineers—Pacific General Meeting, Pasco, Washington, Aug. 28-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America — 12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Electric Companies Public Information Program—Steering Committee, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

• **Edison Electric Institute**—Industrial Power & Heating Group, Van Curler Hotel, Schenectady, N. Y., Sept. 11-13; Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25, Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colorado, Sept. 30-Oct. 1.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Southeastern Electric Exchange—Engineering & Operation Section, Biltmore Hotel, Atlanta, Ga., Sept. 19-20.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

• **Missouri Valley Electric Association**—Accounting Conference, President Hotel, Kansas City, Mo., Sept. 23-24.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

• **Missouri Valley Electric Association**—Sales & Rural Conference (and Home Service Workshop), Lassen Hotel, Wichita, Kansas, Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

Iowa Utilities Association—Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, American Hotel, Allentown, Pennsylvania, Oct. 21-23.

Edison Electric Institute—Prime Movers Committee, Hotel New Yorker, New York City, Oct. 7-9; Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Va., Oct. 23-25.

National Electronics Conference, Inc—13th Annual Meeting, Hotel Sherman, Chicago, Ill., Oct. 7-9.

• **American Institute of Electrical Engineers**—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11; Computers in Control Symposium, Hotel Claridge, Atlantic City, N. J., Oct. 16-18.

Southeastern Electric Exchange — Accounting Section, Fort Sumter Hotel, Charleston, S. C., Oct. 10-11; Sales Section, Tutwiler Hotel, Birmingham, Ala., Oct. 16-18.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., Oct. 14.

Oklahoma Utilities Association — Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla. Oct. 25.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

Edison Electric Institute — Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

Pacific Coast Electrical Association — Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

DECEMBER

• **American Society of Mechanical Engineers**—Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

• **Electric Companies Public Information Program** — Steering Committee, New York City, Dec. 11.

• Additions this week.

TO BUILD YOUR LIGHTING BUSINESS . . .

Enter The 1957 International

Stories on top winning entries will be published in ELECTRICAL WORLD

Local publicity will stimulate lighting business!

$5,400.00 in cash prizes will be awarded!

Have you completed an outstanding lighting job since January 1st, 1956? Do you have one planned—or working—to be finished before October 25th, 1957? Why not let that job bring you extra profit . . . and industry-wide recognition? Enter it in the 1957 International Lighting Competition!

The competition is open to any individual who is either the owner or manager, or an employee of any of the following types of business, provided he complies with all the requirements outlined in the official rules of the competition: 1. Electrical Contractor. 2. Electrical Wholesale Distributor. 3. Architect or Engineer. 4. Electrical Utility.

The contest opens March 15th, and closes October 25th. Announcement of award winners will be made during the week of November 11, 1957.

The competition is sponsored by three McGraw-Hill publications: Electrical World . . . Electrical Construction and Maintenance . . . Electrical Wholesaling . . . with the cooperation of the National Lighting Bureau (National Electrical Manufacturers Association).

Commercial, industrial and institutional lighting installations winning cash prizes will be certified by the National Lighting Bureau, NEMA, providing the installation plans meet certification standards. Certificates will be presented to all cash prize winners, and honorable mention winners. In case of tie, duplicate awards will be made. Wherever practical, awards will be made locally; if possible at electrical group meetings.

Send in the coupon below for detailed information on the 1957 International Lighting Competition. Make your outstanding lighting job pay off in extra cash, and valuable public acclaim!

LIGHTING CLASSIFICATIONS:

Lighting installations are divided into six separate and individual groups. Separate awards will be made for each classification, within each contestant division. The installation classifications are:

1. **Industrial**
2. **Store**
3. **Office**
4. **Institutional**
5. **Outdoor Lighting**
6. **Residential Lighting**

PRIZE AWARDS:

The 120 cash prizes offered, total $5,400.00. There are five prizes for each of the six installation classifications, and these prizes are offered within each of the four contestant divisions. The prize awards for each classification and within each division:

First Prize: $100

Second Prize: $50

Three Prizes: $25 each.

JUDGING:

Competent and fair consideration for each entry has been assured through appointment of nine individuals, each a well-known authority in the field of illumination, to serve as judges. These individuals will form three panels of three members each, to judge the separate lighting classification groups. The decisions of the board with respect to awards and all other competition matters are final and binding on each participant. The competition and awards are subject to all applicable local, state and federal laws and regulations.

Lighting Competition!

OFFICIAL COMPETITION RULES:

RULE 1 — Application to enter the Competition must be made in writing. Applicant may use an Official Entry Application form, which will be supplied by the Lighting Competition chairman upon request. (In any case where the applicant is unable to obtain an Official Entry Application form, he may send in his request to enter by letter).

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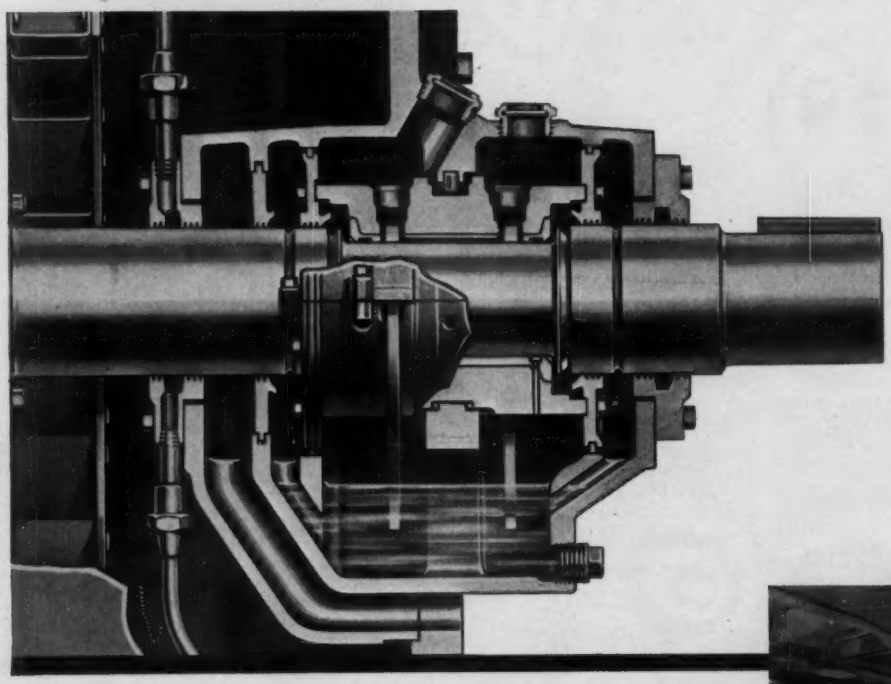

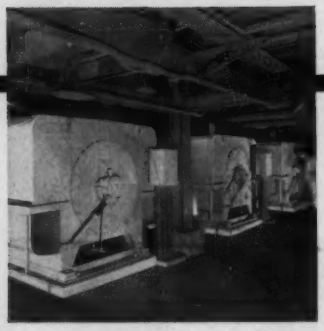

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Volume 147—January-June 1957

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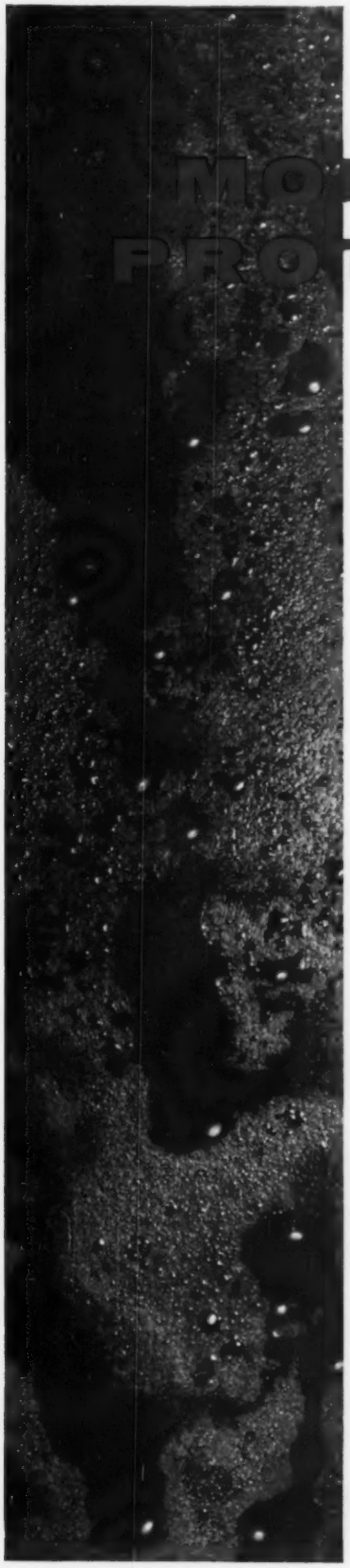

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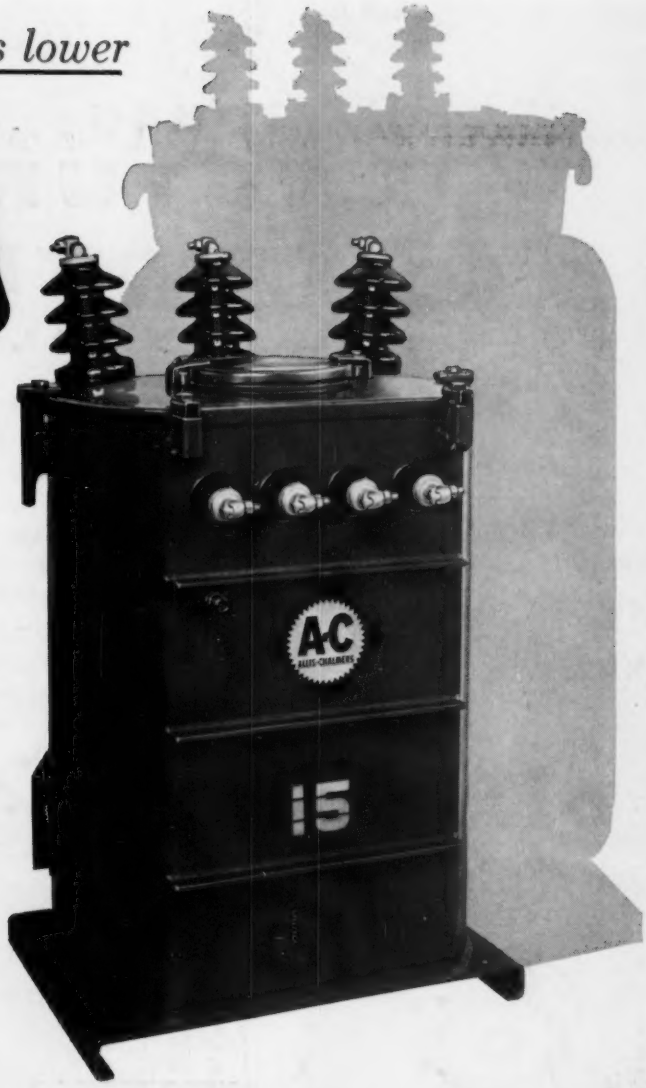

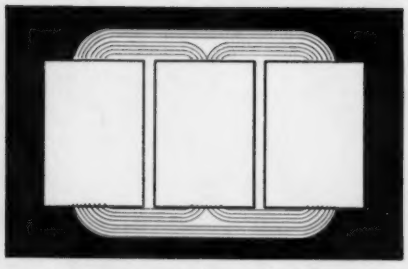

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